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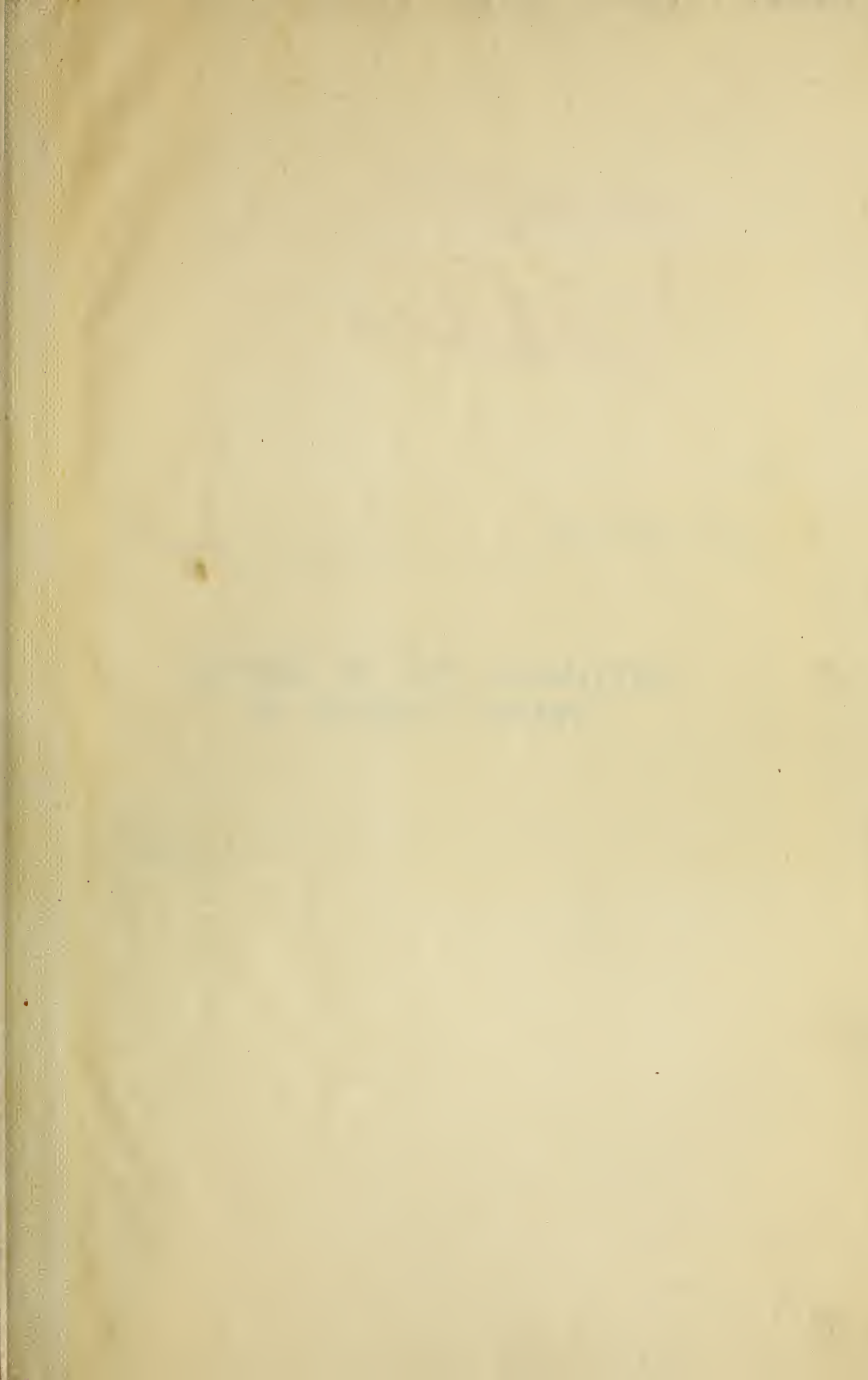
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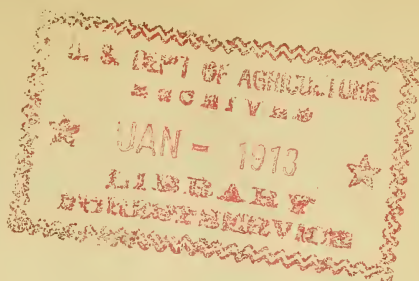
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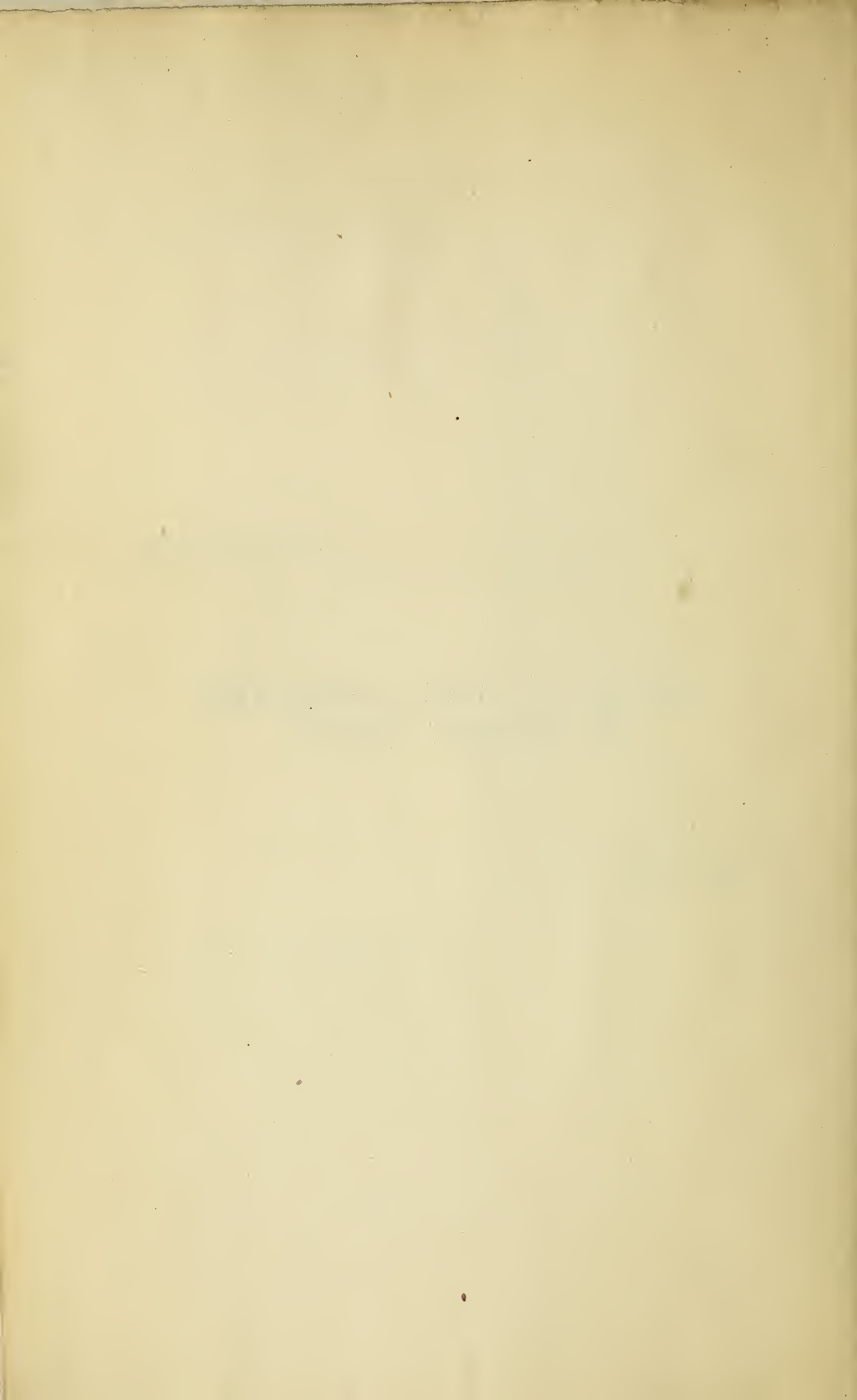


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REPORT OF THE COMMITTEE OF BUREAU CHIEFS.



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LETTER OF SUBMITTAL.

WASHINGTON, D. C., *January 11, 1911.*

SIR: I have the honor to submit herewith the report of certain chiefs of bureaus and offices appointed by you as a committee to inquire into the following subjects: Economy in research, cooperation in scientific work, duplication in scientific work, travel, chemistry as it is or under one head, bureau of health, and anything else making for greater efficiency in the department's work.

At a meeting of the committee on October 6, 1910, the undersigned was chosen as chairman of the committee, and a subcommittee was appointed to consider the whole question, after having been supplied with certain information requested by them from each of the various bureaus, divisions, and offices. This subcommittee was composed of G. H. Powell, chairman; Henry S. Graves, and E. W. Allen.

I am forwarding herewith a report from the whole committee, a summary of the report, and exhibits pertaining thereto. This report, in the main, is as it was received from the subcommittee. At its adoption the following representatives of the respective bureaus and offices were present: A. D. Melvin (chairman), Bureau of Animal Industry; A. C. True, Office of Experiment Stations; E. W. Allen, Office of Experiment Stations; W. D. Bigelow, Bureau of Chemistry; L. O. Howard, Bureau of Entomology; H. C. Frankenfield, Weather Bureau; H. W. Henshaw, Bureau of Biological Survey; Milton Whitney, Bureau of Soils; A. F. Potter, Forest Service; Nat C. Murray, Bureau of Statistics; W. A. Taylor, Bureau of Plant Industry.

Each member voted in favor of the report as it relates to his particular bureau or office except the Bureau of Chemistry. That bureau, through Dr. Bigelow, did not indorse that portion of the report pertaining to it, and the chief of the bureau has since submitted a separate statement, which is appended to this report.

Very respectfully,

A. D. MELVIN,
Chairman of Committee.

Hon. JAMES WILSON,
Secretary of Agriculture.

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REPORT OF THE COMMITTEE OF BUREAU CHIEFS.

ECONOMY IN RESEARCH.

Economy in research means the effective use of funds in the conduct of investigations and experiments rather than a saving by reducing the amount of such work. Such activity from its very character calls for able men and for methods of operation which are unavoidably expensive. This is especially true in agriculture, where so much of what is known is new and requires adaptation to local conditions and where it is often necessary to develop methods as an investigation progresses.

While there is opportunity for extravagance and waste, research can not be put on a purely commercial basis. It contains an element of uncertainty which often results in steps which lead only to negative results. To be reliable, results must be worked out in a thorough and scientific manner, and it is exceedingly difficult to measure the value of the progress made in relation to the money expended.

Efficiency is the only true measure of the wise use of funds for investigation. The most that can be done in the direction of economy by an administrative officer is to secure the greatest possible efficiency—to select the men carefully, insure a definite plan at the outset, provide the facilities which seem to be necessary, and hold the leader for results. Supervision is required to insure continuity of effort and to prevent unwarranted expenditures, and failures to make progress or an apparent lack of ability will call for changes in the interest of economy, but to curtail expenses unnecessarily or by employing cheaper men is false economy, which may defeat the whole undertaking.

Organization is important and any organization which retards efficiency is false economy. Research can not be effectively conducted upon a shop basis of concentrating effort of like kind to secure greater speed or cheapness of production. Economy is real only when it promotes efficiency, accuracy, and zeal. These are secured by surrounding the investigators with conditions which recognize individuality in their work and their writings, and allow freedom from unnecessary restrictions from without the bureaus. Any attempt to break down the integrity of a bureau by taking away from it the preparation of its publications, the photographic records of its work, and the employment and direction of men representing different branches of science as may be needed, would, in the opinion

of the committee, result in no real economy and would be reflected in a loss of individual interest and zeal and make for mediocrity.

Perhaps the most frequent bar to economy is the change in men due to resignations. Research proper is largely an individual product, and in all forms of experimentation the persons connected with it, especially those directing it, become so closely identified with the work that it suffers a temporary setback by a change in personnel. Delay in securing and breaking in new men often greatly diminishes the actual return in a given season from the money expended. Such changes in personnel are often inevitable and are frequently due to offers of increased salary to men who have reached a high stage of efficiency. The man is so preeminent a factor in determining the success of an experiment that true economy suggests the exercise of all reasonable efforts to avoid a change. The salaries for the department's experts have not yet reached those attached to commercial positions.

From a survey of the scientific work of the department the committee is unable to point to means or instances in which greater economy could be exercised without curtailing the work or diminishing its efficiency.

ECONOMY IN TRAVEL.

The lines of work requiring travel may be grouped under three heads: (1) Research work; (2) administrative work; and (3) demonstration and educational work.

RESEARCH WORK.

Most of the bureaus conduct field investigations in various parts of the country, requiring travel. Economy in travel depends primarily on the administrative officer in charge of the work. Wisdom must be exercised in undertaking and conducting an investigation so that there may be no loss of time and effort in the field. It is poor economy to place work in charge of inexperienced men. The research work of the Forest Service, for example, has suffered from lack of trained investigators, young men with little experience detailed to carry on field research covering more ground and spending a longer time in the field than was necessary.

Economy can often be effected by using agents located in the field. Several bureaus now have field stations for research, thus saving travel from Washington. In some cases, notably in the Forest Service, efforts have been made to combine research and administrative work in order to effect economy. Field agents charged with administrative work were required also to conduct research work. Ordinarily such combinations do not yield satisfactory results, and often the work has to be supplemented by a separate investigation.

Administrative officers can gather field data when an intensive investigation is not required. A bureau can often obtain assistance from another bureau or from a department which has an agent stationed in the locality where information is desired. In this way the forest officers are gathering statistics on the sheep industry for the Tariff Board.

The bureaus generally appear to be exercising strict economy in travel involved in research work, and any substantial saving could be effected only by curtailing work and reducing its value.

ADMINISTRATIVE WORK.

All bureaus having administrative work are required to incur traveling expenses for supervision and inspection. There has been a distinct tendency throughout the department to decentralize administrative work and to establish permanent field stations. This has greatly reduced traveling expenses, as demonstrated, for example, in the Forest Service since the organization of local districts for the administration of the national forests.

In a bureau which necessarily has a large force in the field there is often danger of duplication of travel in inspection. This is well illustrated by the first work of the Forest Service. Formerly a single forest would be visited by an expert in grazing, by another in silviculture, and then perhaps by a general inspector, when all the work could have been done by one man in a single visit. Later the inspection work was systematized, and no unnecessary duplication of travel is allowed.

Close cooperation between different bureaus and departments saves much unnecessary travel. The kind of cooperation now in effect between the Forest Service and the Land Office in administering the Federal lands not only makes for efficiency, but saves immense sums to the Government. The examination of water powers is conducted by two different departments, but by cooperation in making the plans and sharing the results duplication of travel is avoided. Often the field agents of one department are able to care for the special local work of another.

DEMONSTRATION AND EDUCATIONAL WORK.

The department not only makes investigations, but it is its duty to make the results of its work of greatest possible use to the public. The organic act places upon the department the duty "to acquire and to diffuse among the people of the United States useful information on subjects connected with agriculture." This is accomplished by publishing information and also by practical demonstrations of methods and by public lectures. Often the only way to secure the adoption of the best methods of agricultural practice is to present

them to the people in a personal way. Most of the bureaus are actively cooperating with States, institutions, public and private associations, and with private concerns and individuals in the demonstration of methods. Agents are sent into the field and traveling expenses are involved. The beneficial results of the work show that it should be extended rather than decreased.

Traveling expenses to a considerable amount are incurred in giving public addresses. The lecture work of the department falls under several heads: (1) Addresses before farmers' institutes, conventions, and meetings of special associations; (2) addresses at colleges and other institutions; (3) lecture tours for Congressmen; and (4) addresses before miscellaneous audiences.

Representation by the department at certain conventions and meetings of associations and other organizations is of great importance. The direct instruction of interested men seeking practical knowledge often accomplishes more in promoting the application of good methods of agriculture than any other method. Usually the person attending is benefited by meeting those dealing with agricultural problems in a practical way. Again, many associations holding such meetings are in active cooperation with the department in investigation and demonstration work. All bureaus sending men to such meetings unanimously testify to the benefit derived.

A limited amount of lecture work at colleges and other institutions is done by various bureaus. The department is the leader in the development of agricultural science. It should interest itself in guiding educational work in agriculture. Discretion seems to have been exercised by the bureaus in this work; it has not been expensive and it seems to be necessary to meet the real responsibilities of the department.

Many requests from Congressmen for lectures in their home districts are received. While most of these have been declined, considerable work of this kind has been done at different times. Exhibit A shows for each bureau the number of requests granted and the number of days required during the past year. There are constant demands for lectures for general meetings. General conventions, women's clubs, church societies, and many other miscellaneous organizations desire good lecturers. Some work of this kind has been done, but usually where the lecturer does not have to travel to any great distance. Generally the expenses are paid, but this has not always been the case.

The public lectures given by members of the department's staff during the year aggregate more than 1,000, but these represent less than 30 per cent of the requests received.

The bureau chiefs appear to be agreed that public lectures are necessary for the effective diffusion of information, but that congressional lecture tours are a drain on the bureaus and are likely to

subject the department to criticism; also that a request for a lecture should not be granted unless it is clearly desirable from the standpoint of promoting the work of the department.

COOPERATION BETWEEN THE BUREAUS OF THE DEPARTMENT.

Cooperation between the various bureaus of the department falls into two general classes: (1) Mutual assistance in research and administration; (2) cooperative research in problems which fall within the fields of two bureaus.

There appears to be no difficulty in the first of the two classes of cooperation. A general spirit of cooperation between the bureaus exists and a desire to extend to each other every assistance possible is apparent. There is a free interchange of information, special data, maps, and even instruments and other equipment. The bureaus conduct a large amount of special work for each other upon request. Thus, the Bureau of Chemistry conducts special chemical investigations for the Bureaus of Animal Industry, Entomology, Plant Industry, the Forest Service, and the Office of Experiment Stations. The Bureau of Entomology investigates problems of insect damage and control for the Forest Service, the Bureau of Plant Industry, and the Bureau of Animal Industry.

There are also many projects in which the bureaus join forces under a more or less formal cooperative agreement. The list which accompanies this report shows that during the past year more than 30 such cooperative projects have been in operation. The method of cooperation varies considerably, according to the character of the work and the funds at the disposal of the several bureaus. The principal methods are as follows:

(1) The expenses of a given investigation or experiment are shared equally. An example is the work of spraying fruit trees, shared equally by the Bureaus of Entomology and Plant Industry.

(2) Representatives of two bureaus work together in the field, each bearing the expense of its particular branch of the work; as, for example, in the investigation of the damage by smelter fumes at Anaconda by the Bureau of Chemistry and the Forest Service.

(3) A bureau loans an expert whose salary and all expenses are paid by the other bureau. Thus the Bureau of Plant Industry has made certain studies of the condition of the forest range for the Forest Service and at the latter's expense.

(4) A bureau furnishes experts, paying salaries and expenses, to conduct special work for another bureau. An example is the work in control of insects injurious to forests by the Bureau of Entomology and the Forest Service. The Bureau of Entomology directs certain work of control of insects on the national forests; the Forest Service bears the expenses of labor in the operation of the control work. Another example is the cooperative work of the Bureau of Plant

Industry and the Forest Service in forest pathology. The former stations experts in the different national forest districts and at Madison and carries on studies for the Forest Service to meet its special needs. The salaries and expenses are paid by the Bureau of Plant Industry. The actual expenses of control work, including facilities, labor, etc., are paid by the Forest Service.

In these illustrations of cooperation the fields of work of the different bureaus are clearly defined. In the joint investigations one bureau furnishes expert assistance in a line of work which the other bureau is not equipped to handle.

In problems which may fall in the field of either of two bureaus according to the point of view with which it is approached, the problem is more difficult. There has been no recognized principle for such cooperative work. Each case has been handled individually and settled by expediency. There are few examples of cooperative projects in which two bureaus share equally in the planning and carrying out of the investigational work. Usually where a problem falls in the field of two bureaus, it is handled wholly by one of them through mutual agreement or there is a cooperative arrangement by which the bureau in whose field the major part of the problem lies assumes direction of the work and the other bureau gives its assistance in handling a part of the problem.

Exhibit B shows the principal cooperative projects between the bureaus of this department.

The character of cooperation will, of course, vary with the grade of the enterprise. In some cases one bureau works for another rather than with it in the sense of sharing the responsibility for the undertaking as a whole. A large part of the cooperative work in the department falls under this head. In other cases the enterprise itself should be cooperative, the representatives from two or more bureaus coming together at the inception of the undertaking to arrange the course of procedure and the various cooperators having a part in, and responsibility for, the investigation. This is the highest type of cooperation.

Where one bureau performs work for another this should be for the purpose of avoiding duplication of equipment and of experts, and if this work is to be of any considerable extent it should be anticipated, in order that time may be arranged for it and funds provided if necessary.

Cooperation should be arranged in such a way as to result in "team work" among those cooperating, and it is also essential that each project as a whole should have direction in order that the work may progress symmetrically. This necessitates a leadership, which must usually be centered in an individual who will follow the project and coordinate its various parts.

COOPERATION WITH OTHER DEPARTMENTS.

The various departments of the Government are accustomed to call upon each other for cooperation and assistance in special work in much the same way as is done by bureaus of this department. In the aggregate there are a large number of such cooperative projects. Exhibit C shows that this department is cooperating with the Department of the Interior through its Land Office, Geological Survey, Reclamation Service, Indian Office, and Bureau of Education; with the Department of Commerce and Labor through the Bureau of Corporations, Coast and Geodetic Survey, Bureau of the Census, Bureau of Fisheries, and Bureau of Standards; with the Treasury Department through the Bureau of Public Health and Marine-Hospital Service; and with the Departments of War, Navy, and Justice, and the Smithsonian Institution. Altogether there are more than 50 cooperative projects.

This cooperation results in the saving of a great deal of money to the Government and it is probable that it could be considerably extended.

COOPERATION WITH STATES.

The different bureaus of the department cooperate extensively with the States, the State sometimes making a direct appropriation to bear the whole or a portion of the expense. Very commonly the expenses are shared equally. In still other instances the State pays the expenses of the work and the department contributes merely the salary and traveling and living expenses of the supervising agent. The cooperation may be conducted through the governor or one of the executive departments of a State, such as the State department or the geological survey, or more often it is conducted through the State agricultural experiment station or state college, no money being given to the department, but the cooperating institution furnishing facilities, such as buildings, land, equipment, and often also assistants and labor.

The Bureau of Animal Industry cooperates with 19 experiment stations and 25 State colleges and universities. It has cooperative work also in a number of States with the departments of agriculture, dairy and food departments, etc. The total contributed by the States is more than \$160,000, in addition to facilities, assistants, labor, etc., upon which it is impossible to place a value.

The Bureau of Soils cooperates with 13 States. The work is done through the experiment stations and colleges of five of these and in the remainder through one of the State departments. Altogether \$46,800 is appropriated, in addition to facilities, helpers, etc.

The Bureau of Entomology has cooperative work with 14 States, the work being conducted with experiment stations and colleges in

9 States, while in the others the bureau deals directly with a State department. Facilities and the services of entomologists and assistants are afforded. The value of the cooperative work furnished by the States amounts to several thousand dollars.

The Forest Service has conducted cooperative work during the past year in 15 States, dealing directly with the governor or one of the State departments. It has cooperated also with eight State institutions. Nearly \$6,000 has been furnished directly by the States for the work.

The Office of Experiment Stations has cooperative work with a number of States in addition to the special cooperative work placed upon it by the Morrill Act. In its drainage and irrigation studies it is cooperating with 15 States directly and through colleges and experiment stations. These States contribute more than \$14,000, in addition to facilities, assistants, labor, etc.

The Weather Bureau, the Bureau of Chemistry, the Bureau of Biological Survey, and the Office of Public Roads all have cooperative work with various States, which afford special facilities.

The Bureau of Statistics cooperates with the Minnesota Agricultural College, which furnishes assistance to the extent of about \$2,500.

Exhibit D shows in detail the extent of the work carried on in cooperation by the department and the various States and State institutions.

COOPERATION WITH COMMUNITIES.

Various bureaus of the department cooperate in experimental and other work with counties, municipalities, and communities. As illustrations the following may be cited: The Bureau of Entomology cooperates with three counties in California in the control of insects affecting fruit trees and receives for this work over \$3,000. The Bureau of Chemistry assists communities in securing a pure water supply. The Office of Public Roads assists in developing systems of good roads, the communities usually affording facilities and paying the expenses of the work. The Forest Service cooperates with ranchers in and near the national forests in the protection of important watersheds and in the construction of roads. The Bureau of Animal Industry has cooperative work with various communities in the investigation and demonstration of tuberculin tests.

Exhibit E shows the details of this community work.

COOPERATION WITH PRIVATE AGENCIES.

The department cooperates in various lines of investigation and demonstration with many private agencies, through associations, institutions, companies, and individuals. Sometimes this cooperative work is in connection with investigations. More often the

object is to promote the practical application of methods of work advocated by the department. In other cases the cooperative work concerns the administration and use of Government property, as in building roads and trails in or near national forests or in protecting watersheds lying within a national forest. The private agencies may provide for the expenses of the work with the exception of the salary of the department agent or may pay all expenses, including salaries.

As illustrations of the cooperative work of the department, details of which will be found in Exhibit F, the following may be cited: The Bureau of Animal Industry cooperates with various dairymen's associations, the latter having furnished during the past year \$22,300. The Bureau of Entomology cooperates with private owners in various Western States in the work of insect control, furnishing an expert and paying his traveling expenses, while all other expenses are borne by individuals. The Forest Service has had during the past year cooperative work with more than 40 private owners of woodlands, who have usually provided not only for the expenses but also the salaries of the experts, the total amounting to about \$5,000. There is cooperation in the Forest Service with 70 different associations of stockmen in the administration of forest ranges.

Similar cooperative projects are conducted by the Bureau of Plant Industry, as, for example, the rice investigations in Florida, South Carolina, Texas, California, and Louisiana, in which some \$20,000 has been contributed by private agencies.

Other bureaus are conducting projects of the same general character with associations and other private agencies wherever these can be made to promote the work of the department.

DUPLICATION OF WORK WITHIN THE DEPARTMENT.

Considering the variety of its activities there appears to be little unnecessary overlapping and practically no duplication of work in the department, the administrative direction of the bureaus by the secretary having effectively prevented it. Much of the work that might seem to be a duplication is either an effort to approach a problem from more than one point of view by two bureaus or offices within a bureau or the result of a division of the field when a problem naturally lies and might legally be investigated in two bureaus.

The department is composed of several fundamentally different types of organization established for the purpose of handling research, education, and the administration of law. The research work of the Bureaus of Animal Industry and of Plant Industry, for example, is organized on the basis of broad divisions of agriculture. The work of the Bureaus of Chemistry and of Entomology to a less degree is organized from the standpoint of the sciences and of the methods of research. These different methods of handling public research are

being tested side by side. The methods of organizing agricultural research and education are still in the experimental stage, not only in the department; but in all of the agricultural institutions in the United States.

The problems of agriculture are seldom confined to the arbitrary limits of bureau organization. They naturally extend along the borders of two or more bureaus or extend from the field of one into that of another bureau or several bureaus.

The law authorizing the work of each bureau of the department is very comprehensive in scope. If considered by itself the language appears to permit many general agricultural investigations to be carried on simultaneously in more than one bureau from the respective point of view of each. The law is equally broad in authorizing the different lines of work within a bureau, and in several cases would appear to permit duplication.

The department is, however, under strict administrative direction. Under its organization the limitation of the field of the bureaus, the harmonizing of their work, and the prevention of duplication or overlapping is primarily an administrative function, the Secretary fixing the scope of the problems to be investigated by each bureau under the general authority providing for its work and adjusting the work of the different bureaus to those investigations which each is conducting. Duplication is further avoided by conferences between the bureau officers and by committees within the bureaus.

In order to show the authority for a certain amount of duplicate work in different bureaus, attention is called to Exhibit G, presenting certain clauses in the agricultural bill which appear to permit a problem to be investigated in more than one bureau. The bureau officers have looked carefully into those cases where duplication and overlapping might occur under the authority of each bureau and report that the adjustment of the work has effectively prevented unnecessary duplication and an unwise overlapping. They feel that it is in the interest of the highest efficiency that a problem should be approached from more than one angle. Any effort that would prevent a reasonable checking up of an investigation which naturally runs into the field of different investigators would be at the expense of scientific efficiency and truth and a vital blow at the best interests of agricultural science and of the work of the department. This view has been recognized by Congress in the broad authority provided for the work of the department, and in the administration of the laws the safeguards in the form of administrative direction and supervision effectively prevent unnecessary work of any kind.

In the following lines of work, however, it is possible that a more effective working arrangement than exists at the present time between the bureaus might be made:

(1) The educational work of the Office of Experiment Stations and that part of the educational work of the Farmers' Cooperative Demonstration Work of the Bureau of Plant Industry which brings the officers of the latter bureau in touch with State and county school officials and with the county schools.

The former office deals primarily with educational subjects and methods; the latter uses the public school as a means of interesting the boys and girls in better farming methods. The director of the Office of Experiment Stations suggests a cooperative arrangement whereby all work which brings officers of the department into direct touch with school officials will be done in harmony with the work of that office.

(2) The irrigation investigations of the Office of Experiment Stations and the work of the Bureau of Plant Industry in connection with the reclamation projects and other plant-industry investigations in which water is an essential factor in a crop or problem investigation.

There is no apparent duplication in these lines of work, but the use of water in agriculture needs to be more carefully investigated. At present the irrigation investigations are conducted largely by the Office of Experiment Stations from the engineering point of view, with incidental attention from the agricultural point of view. Though authorized to carry on such work, the Bureau of Plant Industry has not investigated the influence of water on crops to the extent it ought to have done, as there has been no cooperative arrangement between the two organizations. The result is that the question of the use of irrigation water in agriculture is inadequately investigated.

(3) The entomological work on insects injurious to live stock in the Bureau of Animal Industry and the work of the Bureau of Entomology.

There appears to be no duplication here, but it is the feeling of the Bureau of Entomology that this work should be done under that bureau.

(4) The poisonous-plant investigations specifically authorized in the Bureau of Plant Industry and similar investigations carried on in the Pathological Laboratory in the Bureau of Animal Industry.

These investigations could be coordinated so that better cooperation in the work in the field in studying poisonous-plant outbreaks and in the laboratory in the pharmacological studies with plant poisons might be maintained.

(5) The work of the Forest Service and of the Bureau of Biological Survey relating to the destruction of prairie dogs in the national forests.

This work could probably be better coordinated. It appears to fall properly within the sphere of the Bureau of Biological Survey,

but as a matter of expediency is being conducted in the Forest Service.

(6) The statistical work developed in the Forest Service and the work of the Bureau of Statistics.

This work might also be coordinated so that the part which belongs properly to the Bureau of Statistics will not be carried on in the Forest Service. There is no duplication in this line at the present time.

(7) The grain work, drug-plant work, water supply and other investigations of the Bureau of Chemistry, and similar investigations specifically authorized under the Bureau of Plant Industry and work authorized in other bureaus which the work of the Bureau of Chemistry parallels.

There is more opportunity for duplication between the Bureau of Chemistry and the chemical work in other bureaus than in any other work in the department. This is inherent in the present form of organization. In the great majority of cases the chemical work in the other bureaus does not duplicate that of the Bureau of Chemistry, as the scope of the investigations is mutually understood. It is not possible for the Bureau of Chemistry and the other bureaus always to know what work is under investigation and there has been an increasing tendency for the bureaus to take on chemical investigations where they are essential in working out their problems. The chief of the Bureau of Chemistry calls attention as examples of the effect of this tendency to a proposed bulletin by the Bureau of Animal Industry on the use of metallic containers for fats and oils which appears to him to be in its essential features a duplication of an investigation of a more comprehensive nature that has been in progress in his bureau for two or three years. The work of the Biochemic Laboratory of the Bureau of Animal Industry in determining the arsenic content of colors proposed for use with meats seems to the Chief of the Bureau of Chemistry to fall within the work of his bureau in relation to certified colors.

The committee feels that the difficulties in chemical work are inherent in the two forms of organization already set forth and that the avoidance of duplication and overlapping can be effected only by frequent conferences and adjustments by the administrative officers of the bureaus concerned and by further arbitrary adjustments by the Secretary when necessary.

(8) There is opportunity for a general discussion of the relation of the lines of work in the Bureau of Plant Industry in connection with farm-management investigations, the farmers' cooperative demonstration work, the reclamation-project work, the grazing-land improvement investigations, and the work of the Bureaus of Soils and Animal Industry and of the Office of Experiment Stations with somewhat

parallel lines of investigation carried on in the Bureau of Plant Industry. There appears to be no duplication between these lines at the present time and the handling of the work in the different bureaus is primarily a question of departmental policy.

CONCLUSIONS.

The committee believes that the adjustments that are continuously in progress regarding the work of the different bureaus has been effective in keeping the department practically free from unnecessary duplication and the overlapping of work both within and without. It is realized that there is a close interrelationship between the work of the different bureaus; that many of the problems of agriculture can be investigated only when two or more bureaus work harmoniously together, and that the work of one bureau would frequently overlap the work of another if the danger was not recognized by the great majority of workers who strive to prevent the unnecessary expenditure of public funds through the duplication and overlapping of work. There are few questions in department administration that have received more careful consideration in the past and which are more carefully guarded at the present time than these.

Some of the bureaus have committees whose duty it is to consider these questions and to advise the chief of their bureau whether a tendency to duplication appears in its own work or in the work of other bureaus. The committee believes that this question should receive constant advisory attention by a committee in every bureau.

DUPLICATION OF WORK OUTSIDE OF THE DEPARTMENT.

There is found to be little duplication in the work of the department and that of other executive departments, though it is not possible to know exactly how far similar work is carried on in other departments of the Government.

In several instances a line of work similar to that in this department appears to be carried on in another department, but the work of this department is along lines which relate fundamentally to agriculture not developed as such in any other Federal institution. Agricultural investigations, however, are growing in favor in the country, and there appears to be a distinct tendency in some of the departments to bring their work to bear on the problems of agriculture.

STATISTICAL WORK.

The work of the Bureau of Statistics of this department has often been said to duplicate the statistical work of the Census Bureau of the Department of Commerce and Labor and of the Labor Bureau.

This question is discussed in the following manner by the Chief of the Bureau of Statistics:

The agricultural statistics emanating from this bureau are monthly and annual, and no other official agricultural statistics can be gleaned from any other source regarding the United States, except the figures promulgated by the Bureau of the Census decennially. Furthermore, the work of this bureau is not of the same character as that of the Census Bureau. The latter consists of the actual accounting of past performances; the work of this bureau consists in making estimates of areas, conditions, and yields—a work which no other branch of the Government is prepared to or does perform. It is true that the work of different bureaus of the Department of Commerce and Labor are utilized. For example, the statistics of exports and imports, as collated and published by the Bureau of Statistics of the Department of Commerce and Labor, are utilized in preparing statements showing the exports and imports of agricultural products of the United States which are not shown separately in the reports of the Department of Commerce and Labor, but for which information there is constant and incessant demand. We also utilize the figures promulgated by the Bureau of the Census decennially in adjusting and correcting the estimates of this bureau, which, in the course of 10 years, naturally get somewhat more or less out of line with the facts. We also utilize information recorded in the office of the Commissioner of Internal Revenue in connection with the tobacco crop. We find this of considerable assistance to us. But there is not such a thing as duplication of work in this bureau, either within it or outside of it.

The question of duplication of the statistical work of this department was exhaustively investigated in 1907 by the Committee on Expenditures in the Department of Agriculture of the Fifty-ninth Congress. This committee questioned a number of employees of this department, the Commissioner of Labor, the Chief of the Bureau of Statistics of the Department of Commerce and Labor, the chief statistician of the Bureau of the Census in charge of the Division of Agriculture, the chief statistician for manufactures for the Bureau of the Census, and others, regarding the scope of the work under their direction and its relation to the work of this department. The committee reported as follows:

We made an extended examination of Mr. Olmsted with reference to the question as to whether the work that he was doing was being duplicated by any other statistical bureaus in the Government, and so far as we could see there is no duplication in his work. There are a number of divisions or offices in the various departments that are collecting statistics, the principal of which are the Census Bureau, the Bureau of Statistics in the Department of Commerce of Labor, the Labor Bureau, and this Bureau of Statistics in the Department of Agriculture.

While we have not been able to ascertain that there was any substantial duplication in the work of either, our judgment is that the heads of these various bureaus should be required to confer with each other as often as once a month for the purpose of ascertaining whether or not there is such duplication and whether any of the bureaus can avail themselves to advantage of the services of the other bureaus in any particulars, and thus save either direct or indirect duplication of work and economize expenditures.

The committee is able to report that the work of the Bureau of Statistics of this department is even more free from possible duplication now than it was when the Committee on Expenditures reported to Congress in 1907.

EDUCATIONAL WORK.

A part of the educational work of the Office of Experiment Stations in some respects follows along somewhat similar lines to the work in the Bureau of Education. There appears to be no duplication between these two bureaus, the work in the two organizations, through mutual understanding, following different lines, as described by the Director of the Office of Experiment Stations, as follows:

The Bureau of Education and this office are in frequent consultation as to the character of the educational work which each shall perform, and care has been taken to avoid duplication in publications. We approach the subject from the standpoint of agriculture and the desirability of disseminating through the schools information acquired by this department and experiment stations. The Bureau of Education approaches it from the standpoint of the schoolman. The cooperation of these two agencies in the development of agricultural education in the United States is very desirable and it would be well if this were definitely provided by statute, as is done in some other countries.

Under the Morrill Act of 1890, the annual reports of the land-grant colleges are required to be sent to the Secretary of Agriculture as well as the Secretary of the Interior. To provide uniformity in the statistical portion of these reports, this office and the Bureau of Education publishes these in connection with the general statistics of education for the United States. This office publishes the Agricultural College statistics primarily as a means of showing the character of the colleges with which the agricultural experiment stations are connected.

The committee fully indorses this statement.

PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE.

It is believed by the officers of the Bureau of Biological Survey that the work of the Public Health and Marine-Hospital Service in connection with the transmission of plague germs by ground squirrels and other native rodents, in so far as it is connected with attempts to exterminate these well-known agricultural pests, is encroaching on the field properly belonging to the Department of Agriculture.

BUREAU OF STANDARDS.

There seems to be a large opportunity for duplication in the work of this department and the Bureau of Standards. The bureau mentioned has been extending its activities within the last few years and now carries on investigations in many lines under a general clause which provides for "the solution of problems which arise in connection with standards." The paper investigations of the Forest Service, the Bureau of Plant Industry, and the Bureau of Chemistry might easily duplicate or overlap similar work of the Bureau of Standards;

also the timber-testing work in the Forest Service and in the Bureau of Standards. There appears to be no intimation in the organic act establishing the Bureau of Standards that it was to do police work such as it is now largely doing. For 12 years preceding the establishment of the bureau the direction of the sugar laboratories connected with the customs service was by mutual arrangement solely in the hands of the Bureau of Chemistry of this department. When the Bureau of Standards was established this work was transferred to it and placed in the hands of men wholly unacquainted with any of the practical problems connected with the supervision of the analyses of sugar at the ports. Subsequent encroachments of a similar nature have been made until now the chief of the Bureau of Chemistry thinks a large part of the activity of the Bureau of Standards is directed to work which, under the clause permitting the collaboration with other bureaus and departments, should legally and properly be under the control of the Bureau of Chemistry.

ORGANIZATION OF CHEMICAL WORK.

Apart from the chemical work done in the Bureau of Chemistry, or under its direction, certain studies are being conducted which involve the employment of chemical methods, usually incidental to the real purpose or aim of the investigation, in the Weather Bureau, Bureau of Animal Industry, Bureau of Plant Industry, Forest Service, Bureau of Soils, and the Office of Experiment Stations. In the Weather Bureau, the Forest Service, and the Office of Experiment Stations the chemical work is limited in extent and of a special nature; it is physical or physiological quite as much as chemical. The maintenance of chemical laboratories in the other bureaus is a matter of great convenience, if not an absolute necessity, in the conduct of their investigations.

The chief of the Bureau of Chemistry has presented a strong argument for the concentration of all the chemical work under a single direction, "although the nature of the work may be of a character in which it would not be expected that any one director would be an expert in all forms of the work," and he adds:

To my mind there is no question but that the greatest economy in the utilization of chemical science for economical service would be secured by a central bureau to which would be referred all work of a chemical nature, or of a scientific nature nearly allied to chemistry, necessary for the conduct of the Government. So broad a concept, however, is almost foreign to the present proposed instructions of the Secretary, which are to see what can be accomplished within the Department of Agriculture by a closer coordination of the activities of the various bureaus.

As a contribution to this investigation, I would state that the Bureau of Chemistry will be glad to offer its services for the chemical investigations in the study of chemical problems as they affect every branch of the departmental service.

In proposing the transfer of the chemical work of the whole department to one organization, Dr. Wiley explains that "this does not mean that the work shall not be done within a given bureau, but it means that there shall be one source of supplies, one director of work, one system of organization, although the workers may be detailed when desired to different bureaus and different parts of the country just as they are to-day." He states that his bureau would be able to provide this service and to arrange for prompt attention in special cases. He advocates the organization of the department's scientific work on the basis of the sciences and points to the present tendency to depart from this plan, only two of the scientific bureaus of the department having retained their identity, namely, Chemistry and Entomology. This, it seems to the majority of the committee, is the crucial point.

// In the development of the department's research work the employment of chemical methods and apparatus has been found necessary in many different directions, as chemistry touches the problems of agriculture at many vital points. The provision of facilities for such work within the bureaus is a logical outgrowth of the organization of the scientific work on the basis of the problem or group of problems as presented in agriculture rather than on the basis of the separate sciences. In this organization chemistry is recognized as a method or aid in agricultural investigation rather than as a division of the subject. It is but one of the many methods of procedure, and the chemical methods and the point of view of the chemist are employed in combination with the methods of other sciences and with practical considerations. These things can not be divorced or widely separated in agricultural investigation without a loss of efficiency. //

Agriculture has profited by investigations in chemistry when the latter overstepped the bounds fixed by pure science and combined with other sciences in its attack on these complex problems. Liebig's work for agriculture began when he applied his chemical methods and point of view to the nutrition of the plant, a problem in physiological botany, and to the nutrition of the animal, which led him into physiology. In our work to-day chemistry must be applied along with other sciences, and these need to go hand in hand. By association with a particular group of problems the chemist acquires a knowledge and an insight which make him resourceful in attacking these problems. Again, the requirements of the case may call for a chemist with a knowledge of geology as applied to the origin of soils, or one also versed in bacteriology for studying the processes of nitrification as influenced by various conditions, or one with some branch of engineering knowledge to fit him for special work. Because chemical methods and chemical knowledge are employed along

with other branches of science it does not necessarily follow that the work is to be grouped under chemistry. Most of our agricultural research demands an outlook beyond the purely chemical phases. Thus the requirements are, to some extent at least, specialized. Whether this special knowledge is acquired before entering the department or through close association with its investigations, it becomes invaluable to the investigator in making the chemist more resourceful and more skillful in attacking research problems. In a word, the chemist is needed in agricultural research to assist in planning the line of attack, as well as to carry out the routine determinations, and he becomes expert in this through close connection with a particular line of investigation. This is true whether he is the leader or an assistant. The chemist and his work are a necessary integral part of the investigation.

It has been suggested that economy of effort is secured by coordination of work, and while this is true, at least theoretically, of certain mechanical operations, the majority of the committee dissent from this view in its general application to the sciences in research. It is contended that in reasonable limitations investigators should not be hampered by being deprived of assistants under their direct control who are qualified to carry out original lines of work, although work of a similar character may be conducted in some other branches of the department. There is no essential difference between having a room fitted for making nitrogen determinations and one provided with desks and microscopes, lenses, staining fluids, and other accessories for studying plant and animal tissues; and investigation would often be seriously handicapped by an organization which prevented the employment of such facilities of either kind in direct connection with the investigation. Rarely can such work be farmed out to advantage, and this must be the real measure of the practicability of such an organization, for the first requisite of economy in the true sense is efficiency.

It is possible that some means might be found for coordinating the work so as to insure general uniformity in methods and a clearer understanding of the work in different bureaus, but it is not believed that a system of detail from a central bureau would be advisable. The chemist, like the other investigators, must be under the control of the leader as far as his work is concerned and should feel his first allegiance to the bureau which he serves. In no other way can the proper esprit de corps be insured.

While the committee holds the above to be an underlying principle in agricultural investigation as at present organized, the case is quite different with control work or miscellaneous analytical work. Here it is not a question of developing methods for solving a problem in which chemistry figures as one of several factors; the interest

centers primarily in the analytical results themselves. The man in charge of the experiment need not necessarily come in close contact with the analyst. His desire is merely for prompt and reliable analyses, and he expects little by way of suggestion from the chemist. A great deal of the department's chemical work is of this character, and, as Dr. Wiley points out, the greater part of it is now done within the Bureau of Chemistry. Where the chemical work does not form an integral part of research, but is itself an end product, the application of the results being left to the leader, there is believed to be economy and advantage in pooling the work of the department in common laboratories so far as may be practicable.

WORK IN BACTERIOLOGY.

The investigations in the department have shown that bacteria and other minute living forms, with their products, are related to the work of all or nearly all the bureaus. Bacteria and their products affect the purity of foods investigated in the Bureau of Chemistry, and lie largely at the basis of the work of meat inspection and in much of the other work of the Bureau of Animal Industry; both in their own character and in their effects on other organisms they are investigated in the Bureau of Plant Industry; they effect important changes in the physical and chemical properties of soils, and both directly and through their products they influence the functioning of soils; and they are involved in the investigations of pests and animal diseases in the Bureaus of Entomology and of Biological Survey. It has become clear that bacteriology must be considered broadly as related to those manifestations of vitality fundamental to all problems of animal, plant, and soil investigation with which agriculture generally is concerned. Accordingly, bacteriology may be regarded as elementary in the work of the department; it has come to be a means rather than an end in most of the lines of investigation pursued; and it is not practicable to concentrate bacteriology within a single bureau.

BUREAU OF PUBLIC HEALTH.

The establishment of a bureau of public health would unquestionably promote the general welfare of the people if it is organized and conducted along reasonable lines. This bureau would naturally embrace all of those investigational and other efforts of the Government that relate primarily to the health of the people. Two tests can fairly be applied in considering the department in which a line of work should naturally be developed: (1) Where does the work rightly belong on the basis of its subject matter? (2) Where can it be developed most effectively?

It is the opinion of the committee that through those two tests the work of the department that relates primarily to the public health can readily be separated from its agricultural activities, and that those lines of work that have an incidental relation to the public health and a major relation to other activities should not be included in a bureau of public health. No work of the department should be included in such a bureau where the major part of the investigation is conducted from an agricultural point of view.

THE BUREAU OF ENTOMOLOGY.

In the Bureau of Entomology the work appears to be of three kinds: (1) Pure research; (2) hygienic research; and (3) agricultural research.

The affiliations of the pure research work might be considered to be evenly balanced between this department and the bureau of public health; but the scientific resources of the department in the form of libraries, laboratories, and a corps of specialists already developed and the association between the department and the entomological workers in the State agricultural experiment stations make the department the most effective and the logical place for carrying on governmental work of this type.

The entomological work bearing upon public health is destined to increase rapidly. The results already obtained are of incalculable value. The diseases in man and the domestic animals not known to be caused by insect life, as well as the rôle played by insects in the distribution of diseases, have given to those phases of entomology great publicity and value. Unquestionably, new discoveries of the greatest hygienic importance are destined to be made in the future. The work in this field, other things being equal, would seem to fall logically within the scope of a bureau of public health. The Chief of the Bureau of Entomology believes, however, that as a matter of practical expediency the work should remain in this department. He says:

I consider that it would be very inadvisable to turn over any portion of the work of this bureau to a bureau of public health, even that portion which relates to the carriage of disease by insects. The reasons for this are that in the Bureau of Entomology we have very large collections, an admirable library, and a corps of more than 100 experts, many of whom are specialists in different groups of insects. All necessary work on the insects affecting health can, therefore, be carried on to much greater advantage in the Bureau of Entomology than in any other institution, and, should any other institution undertake work in this direction, it would be necessary constantly to consult and work with members of the force of the Bureau of Entomology. As a matter of fact, there is a distinct cooperation between the Bureau of Entomology and the Public Health Service at the present time, the Chief of the Bureau of Entomology being the consulting entomologist (without compensation) of the Public Health and Marine-Hospital Service.

A parallel may be drawn between this proposition and the present relations between the Forest Service of the Department and the Bureau of Entomology. There is in

the Bureau of Entomology a section devoted to the investigation of forest insects. It might seem at first glance as though this work should be carried on under the Forest Service, but the arguments given above in the case of the proposed bureau of public health hold equally in this case, and the Chief of the Forest Service and his principal assistants agree that the arrangement is productive of better results than such a lumping as is suggested in the case of the public health bureau.

The agricultural division of entomology contains the greater number of insect forms economically associated with the work of the people; it involves millions of money in the discovery and control of pests. To disassociate this larger phase of entomological work from the agricultural interests of the country would be an injury to science and a disaster to agriculture. The revelations of the sinister rôle played by insects in matters of public health have deservedly aroused great interest, but it should not divert attention from the fact that the agricultural interest of entomology is even greater.

THE BUREAU OF ANIMAL INDUSTRY.

The Bureau of Animal Industry carries on work along the following lines: Meat inspection, inspection of animals for export, inspection and quarantine of imported animals, eradication of diseases of live stock, scientific investigations of such diseases, investigations in animal breeding and feeding, and work in the interest of the dairy industry and for the improvement of the milk supply.

All of these lines of work, with the exception of meat inspection, are carried on primarily from the agricultural point of view, and it is the feeling of the bureau officials that these lines of work should unquestionably remain in this department. Some of the poultry diseases may bear on public health, and where they do there should be cooperation between the two bureaus, and the bureau of health should, if necessary, develop this particular phase or any other phase primarily related to the public health.

The work in connection with the study of animal diseases is somewhat related to human health, as it is certain that numerous animal diseases are transmissible to man. This study is therefore somewhat closely related to some of the work that a bureau of health should perform. The investigations, however, are primarily agricultural and have to do with the relation of the diseases to animal production and not their relation to human health, except in a minor degree. It would seem logical that a new bureau or department of health should concern itself with a number of problems closely related to animal health, and that the bureau would be expected to build up a division of its own, organized to attack especially the human-health phase of the question without in any way interfering with the organization and usefulness of the existent division for studying animal pathology per se.

The work of the dairy division is also closely related to human-health problems, but the inspection work of this division is carried on primarily from the agricultural point of view. A bureau of health should develop an inspection division giving special attention to compelling producers to handle their dairy products so that they may not constitute a menace to public health, but the work along these lines in this department which is intended to build up a better dairy industry should not be interfered with.

The work of the quarantine division has a very remote contact with human health, and it should very properly be located in the Bureau of Animal Industry.

Related to all of the work of the Bureau of Animal Industry is the fundamental and scientific study of zoological problems. These investigations are indispensable to the proper conduct and future development of animal industry. The work in that bureau has been developed especially to meet the needs of the agricultural community. It will no doubt be necessary to carry on much similar work in a new bureau or department of health, though this will not necessarily constitute a duplication of work. It will be especially necessary to develop more thoroughly the scientific investigations of those low animal organisms, especially the protozoans, some of which are known to produce disease in man and many more of which probably do likewise. The development of this work in a bureau of health will not dispose of the necessity for similar basic investigations of organisms producing disease in animals.

The work of the Bureau of Animal Industry which has most to do with the public health is that of meat inspection, the primary object of which is the protection of human health. It would seem that a large part of this work would properly belong under a bureau of health, except so much of it as relates primarily to the production, handling, and marketing of meat. This part should remain where it is.

The chief of the Bureau of Animal Industry does not believe that any part of his bureau can be conveyed to a bureau of health without detriment to the service, even though it is granted to be a public-health measure. He points out that the human and animal phases of the work of his bureau can not be economically divided; that the men used in inspection are transferred in slack-times to the work of disease eradication and that in emergency outbreaks, such as the contagious foot-and-mouth disease in 1908, the malady would probably have spread widely and would have reached the stock-raising regions of the West if the reserve men utilized in meat inspection could not have been utilized for the field work in combating it.

THE BUREAU OF CHEMISTRY.

The work of the Bureau of Chemistry that has to do with the administration of the pure food law and all of the investigations of the bureau that are related to the administration of the law or to the question of public health would logically belong to the bureau of health. All of the investigations of the Bureau of Chemistry are conducted primarily from the agricultural point of view, such as the denatured alcohol investigations, the poultry and egg handling investigations, the chemical work relating to different crop plants, the vegetable physiological investigations, the animal physiological, and the enological, chemical, and agricultural work of the special laboratories.

THE BUREAU OF PLANT INDUSTRY.

The only work in the Bureau of Plant Industry that might be considered in connection with a bureau of health is that on drug plants and poisonous plants. These investigations, however, are carried on primarily from the agricultural point of view, the leading motive being to establish domestic industries in order that the American drug supply may be grown in the United States rather than in foreign countries.

CONCLUSION.

The general principle may be laid down that only such investigational work as is clearly and directly related to human health should be transferred from existing bureaus to the proposed organization.

SUMMARY.

ECONOMY IN RESEARCH.

From a survey of the scientific work of the department, the committee is unable to point to means or instances in which greater economy could be exercised without curtailing the amount of work or diminishing its efficiency. The measure of economy is the efficiency developed in the man, and this must be judged in a broad way, for it is difficult to measure the value of the progress made in relation to the money expended.

While there is undoubtedly opportunity for extravagance and waste, research can not be put on a purely commercial basis. Such activity calls for the employment of able men and of methods which are unavoidably expensive. To curtail necessary expenses or attempt to save by employing cheaper men is false economy, which may defeat the whole undertaking. The organization of research upon a shop basis by concentrating effort of like kind to secure greater speed or cheapness of production endangers the efficiency and productivity of

the investigator and his assistants. The breaking down of the integrity of a bureau by taking away from it the preparation of its publications, the photographic records of its work, or the freedom to employ and direct men representing different branches of science as may be needed would result in no real economy and would be reflected in a loss of individual interest and zeal and make for mediocrity.

The most frequent bar to economy in research is the change in men due to resignations to accept positions at higher salaries. Such changes result in a temporary setback to the work and loss of time in breaking in new men, which often greatly diminishes the return in a given season for the money expended. Any consideration of economy in the department is likely to be based on commercial standards, but the salaries for its experts have not yet reached the rewards of commercial positions.

ECONOMY IN TRAVEL.

Traveling expenses are incurred in research work, administrative work, and in demonstration and educational work.

Both efficiency and economy are effected by separating as far as possible research work from administrative work.

Economy in travel depends primarily on effective organization of the work.

Close cooperation and avoidance of duplication within a bureau and between bureaus are required for economy.

The establishment of field stations has resulted in economy, both in research and administrative travel.

It appears that the different bureaus have exercised careful economy in travel, both in research and administrative work.

The department is charged not only with the conduct of investigations, but also with making the results of its work of the greatest possible use to the public. This is accomplished by publishing the information, and also by practical demonstration of methods and by public lectures.

The demonstration work of the department is carried on very largely in cooperation with States, institutions, communities, and private agencies. In this demonstration work at least a part of the expense is usually borne by the cooperating agency. The expense to the department in this way is reduced to a minimum.

Traveling expenses in considerable amount are incurred in giving public addresses. The lecture work of the department falls under the following heads: (1) Addresses before farmers' institutes, conventions, and meetings of special associations; (2) addresses at colleges and other institutions; (3) lecture tours for Congressmen; (4) addresses before miscellaneous audiences.

Representation by the department at certain conventions, association meetings, and other organizations is of very great importance. Through these meetings the department is able to reach a large number of interested persons and to accomplish more for the application of good methods of agriculture than can possibly be secured in any other way.

The department is the leader in the development of agricultural science. The limited amount of lecture work at colleges and other institutions done by the various bureaus is not only fully justified, but is necessary to meet the real responsibilities of the department in guiding educational work in agriculture.

There are many requests by Congressmen for lecturers from the department. During the last year about 60 requests were granted for assistance in congressional tours. The time expended was equivalent to 540 days for one man.

There are constant demands for lectures before general meetings. An occasional request is granted, but the majority are declined.

During the past year the total number of public lectures given by members of the department aggregated over 1,000. This represents probably considerably less than 30 per cent of the requests which were made.

There is an apparent full agreement that public lectures are necessary for the effective diffusion of information. It is also the agreement that requests for lectures should not be granted except when in the judgment of the chief of the bureau concerned, approved by the Secretary, it is clearly desirable from the standpoint of promoting the work of the department.

COOPERATION BETWEEN BUREAUS.

There is a very general spirit of cooperation among bureaus and a desire to avoid duplication of work and encroachment by one bureau upon the field of another.

Cooperation falls into two general classes: (1) Mutual assistance in research and demonstration; (2) research in problems which fall within the fields of two bureaus.

The bureaus conduct a large amount of special work for each other upon request.

There are many projects in which the bureaus join forces under a more or less formal cooperative agreement. During the past year there have been over 30 such cooperative projects in operation.

The method of cooperation varies considerably according to the character of the work and the funds at the disposal of the several bureaus. The principal methods are as follows: (1) The expenses of a given investigation or experiment are shared equally; (2) representatives of two bureaus work together in the field, each bearing the

expense of its particular branch of work; (3) a bureau loans an expert, whose salary and all expenses are paid by the other bureau; (4) a bureau furnishes experts, paying salaries and expenses, to conduct special work for another bureau.

In problems which may fall within the field of either of two bureaus, there has not been so far any recognized principle for cooperative work. Each case has been handled individually and settled by expediency.

The principal cooperative work in the department is that in which one bureau works for another. The prime purpose of such cooperation should be to avoid duplication of equipment and of experts.

There are few examples of cooperative projects in which two bureaus share equally in planning and carrying on investigative work. Usually where a problem falls in the field of two bureaus it is handled wholly by one of the bureaus through mutual agreement.

Cooperation in which two bureaus have practically an equal share in the planning and direction of the work must continue to be exceptional, although this is the highest type of cooperation.

In enterprises wholly cooperative one or another of the bureaus must ordinarily assume the direction of the work. In general, that bureau in whose field the major part of a given problem lies should assume direction of the investigation and the other bureau give cooperative assistance.

COOPERATION WITH OTHER DEPARTMENTS.

The department cooperates with other departments, both in research and in administrative problems. The method of cooperation is similar to that obtaining between bureaus within the department.

There is cooperation with the Geological Survey, Reclamation Service, Indian Office, and Bureau of Education of the Department of the Interior; with the Bureau of Corporations, Coast and Geodetic Survey, Bureau of the Census, Bureau of Fisheries, and the Bureau of Standards of the Department of Commerce and Labor; with the Bureau of Public Health and Marine-Hospital Service of the Treasury Department; with the Smithsonian Institution; and with the Departments of War, Navy, and Justice.

There are altogether more than 50 cooperative projects with other departments.

COOPERATION WITH STATES.

The different bureaus of the department cooperate extensively with the States. In some cases the State makes a direct appropriation of money to bear the whole or a part of the expenses. A great deal of

the work is conducted through State institutions, which furnish facilities such as buildings, land, equipment, and often also assistants and labor. No exact data can be given as to the amount of money furnished by the States, as much of the cooperative help is through facilities rather than special expenditure of money. The value of the cooperation would amount probably to between \$250,000 and \$300,000.

OTHER COOPERATIVE WORK.

The different bureaus of the department cooperate extensively with communities and with private agencies in demonstration work and in investigations. These various agencies furnish help to the value of many thousands of dollars and enable the department to extend its influence widely at relatively small expense.

DUPLICATION OF WORK WITHIN THE DEPARTMENT.

There appears to be little unnecessary overlapping and practically no duplication of work in the department, much that might appear to be a duplication being in reality an effort to approach a problem from more than one point of view or a division of a field where a problem naturally lies in two bureaus.

The problems in agriculture are seldom confined to the arbitrary limits of bureau organization, while the law authorizing the work appears to permit many general agricultural investigations to be carried on in more than one bureau from the point of view of each.

The avoidance of duplication and overlapping can be effected only by frequent conferences and adjustments by the administrative officers of the bureaus concerned and by arbitrary adjustments by the Secretary when necessary. In view of the method of organization this becomes an increasingly important administrative question.

DUPLICATION OF WORK OUTSIDE OF THE DEPARTMENT.

Little duplication in the work of the department and other executive departments exists. Apparently similar work in other departments refers directly to other subjects than agriculture, though there appears to be a distinct tendency in some departments to bring their work to bear on agricultural problems.

PREPARATION OF PUBLICATIONS.

One of the most important functions of each bureau is the preparation of publications. This involves the consideration of both subject matter and form of presentation, including illustrations, tables, and rhetorical and grammatical details.

The number of authors in each bureau and the variety of publications necessary to present the work of the bureaus for different purposes make it necessary that manuscripts shall be carefully reviewed in each bureau before transmission for publication. It is essential to scientific accuracy and creditable presentation of the results of the bureau's work that much detailed work shall be done within the bureau in getting the manuscript into proper form for the chief's approval.

While the publications are passing through the press such proof reading should be done within the bureaus as will insure the scientific accuracy and proper form of statement of the bureau's work. Proper indexing, citation of references, etc., often require such technical knowledge of the subject matter that such work can best be done within the bureau and immediately under scientific direction.

The number of publications now prepared by each bureau is so large that the time of one or more persons is required to attend to the details of the preparation of manuscripts and the necessary proof reading and indexing. It is therefore in the interest of neither economy nor efficiency to have such work attempted outside of the bureaus.

In general, each publication should be made complete for printing within the bureau dealing with its subject matter, and the bureau should be held responsible for its accuracy in details.

ORGANIZATION OF CHEMICAL WORK.

In the development of the department's research work, the employment of chemical methods and chemical apparatus has been found necessary in many different directions. The provision of facilities for such work within the bureaus is a logical outgrowth of the organization of the scientific work on the basis of the problem or group of problems rather than on the basis of the pure sciences. In this organization chemistry is recognized as a method or aid in agricultural investigation rather than a division of the subject. It is but one of the many methods of procedure, and the chemical methods and point of view of the chemist are employed in combination with the methods of other sciences and with practical considerations. These things can not be divorced or widely separated in agricultural investigation without a loss of efficiency.

In its research work the department aims to solve problems which are often of great breadth and complexity, and efficiency in this respect calls for leadership. Such leaders should be permitted to rally around them associates representing the various sciences as needed and to employ the methods of those sciences at will. The chemist, like other assistants, must be under the control of the

leader and should feel himself a part of the investigation. For this reason it is not believed that a system of detail from a central bureau would be advisable. The case is quite different with control work or routine analytical work incidental to ordinary experiments. Here it is not a question of developing methods for solving a problem and the man in charge of the experiment need not necessarily come in close contact with the analyst. Where the chemical work does not form an integral part of the research but is itself an end product, the application of the results being left to others, there is believed to be economy and advantage in pooling the work in common laboratories, and the extension of this practice is recommended.

BUREAU OF PUBLIC HEALTH.

The establishment of a bureau of public health would unquestionably promote the general welfare of the people if it is organized and conducted along reasonable lines.

The work of the department that relates primarily to the public health can readily be separated from its agricultural activities, and those lines of work that have an incidental relation to public health and major relation to agricultural activities should not be included in the new bureau.

EXHIBITS.

EXHIBIT A.

Lectures on agricultural subjects delivered at the request of Members of Congress in their home districts.

Bureau.	Requests granted.	Time expended.
		<i>Days.</i>
Bureau of Plant Industry.....	23	172
Office of Public Roads.....	16	171
Bureau of Chemistry.....		
Bureau of Animal Industry.....	14	125
Bureau of Entomology.....		
Bureau of Soils.....		
Bureau of Biological Survey.....		
Office of Experiment Stations.....	6	66
Forest Service.....	3	6

EXHIBIT B.

Cooperation between the bureaus.

Cooperating bureaus.	Character of project.	Method of cooperation.
Weather Bureau and Forest Service.....	Investigation of forest influences, Rio Grande National Forest.	Both bureaus share in the expenses.
Do.....	Investigation of forest influences, Coconino National Forest.	Weather Bureau furnishes and installs instruments; Forest Service bears all other expenses.
Weather Bureau and Bureau of Plant Industry.....	Study of relation between climatic conditions and plant growth.	General cooperation.
Bureau of Animal Industry and Bureau of Chemistry.....	Handling and marketing of eggs.....	Do.
Do.....	Inspection of dairies producing milk entering into interstate commerce.	Do.
Bureau of Animal Industry and Biological Survey.....	Experiments with rat viruses.....	Do.
Do.....	Study of diseases of wild ducks.....	Do.
Do.....	Shipment of game.....	Do.
Bureau of Animal Industry and Forest Service.....	Control and protection of stock diseases on the national forests.	Bureau of Animal Industry furnishes experts to examine losses of stock.
Do.....	Enforcement of quarantine regulations.....	Forest Service assists through local officers on national forests.
Bureau of Plant Industry and Bureau of Chemistry.....	Miscellaneous cereal investigations.....	Bureau of Chemistry furnishes laboratory facilities and services of expert.
Do.....	Chemical studies of muskmelons.....	Bureau of Chemistry furnishes field expenses of chemical side of work; Bureau of Plant Industry provides balance.
Do.....	Study of fruit by-products and ripening processes of fruit.	Bureau of Chemistry furnishes one-half salary of assistants and facilities.
Bureau of Plant Industry and Bureau of Entomology.....	Experiments in spraying fruit trees.....	Expenses divided.
Do.....	Control of insects injurious to tobacco.....	Expenses borne by Bureau of Entomology.
Do.....	Study of fruit insects at Arlington.....	Bureau of Entomology provides cost of maintenance of orchard.
Do.....	Investigation of truck crop insects at Brownsville, Tex.....	Joint investigation.
Do.....	Demonstration and experiments in orchard spraying in Virginia, Michigan, Kansas, Georgia, and West Virginia.	
Bureau of Plant Industry and Forest Service.....	Investigation and control of diseases of trees in national forests.	Bureau of Plant Industry furnishes salary and expenses of experts (about \$10,000); Forest Service bears expenses of control work.
Do.....	Study of poisonous plants on forest range.....	Bureau of Plant Industry furnishes experts; Forest Service provided \$225 field expenses in addition to facilities.
Do.....	Study of diseases of wood.....	Bureau of Plant Industry furnishes expert stationed at Madison; Forest Service bears other expenses.
Do.....	Investigation of improvement of forest range in Oregon.....	Bureau of Plant Industry furnishes experts; all salaries and expenses borne by Forest Service (\$11,820).
Do.....	Willow culture at Arlington.....	Bureau of Plant Industry provides land; other expenses borne by Forest Service.

Cooperation between the bureaus—Continued.

Cooperating bureaus.	Character of project.	Method of cooperation.
Bureau of Plant Industry and Forest Service.....	Introduction of eucalyptus in Florida.....	Bureau of Plant Industry furnishes stock up to \$100 and supervises propagation; Forest Service bears other expenses.
Forest Service and Bureau of Entomology.....	Investigation and control of insects on national forests.....	Bureau of Entomology furnishes salary and personal expenses of experts; expenses of control work furnished by Forest Service.
Forest Service and Office of Experiment Stations.....	Introduction of the study of forestry in schools.....	Forest Service prepares bulletins; Office of Experiment Stations coordinates work and publishes results.
Forest Service and Office of Public Roads.....	Construction work on the national forests.....	Office of Public Roads details experts to advise and assist in planning construction.
Forest Service and Biological Survey.....	Eradication of destructive animals on national forests.....	Biological Survey furnishes advisory experts.
Office of Experiment Stations and Bureau of Animal Industry.	Drainage plans for Morgan farm.....	Salary of expert furnished by Office of Experiment Stations.
Office of Experiment Stations and Bureau of Plant Industry.	Drainage plans for Indian school at Carlisle.....	Office of Experiment Stations provides salary of expert.

EXHIBIT C.*Cooperation with other departments.*

Cooperating bureaus.	Character of project.	Character of cooperation.
Weather Bureau and Geological Survey.....	Study of problems of water and water resources.....	General cooperation.
Bureau of Animal Industry and Navy Department.....	Manufacture and handling of butter for the Navy.....	Navy Department furnishes help and equipment (\$1,400).
Do.....	Meat inspection.....	
Do.....	Testing herds at Annapolis.....	
Bureau of Animal Industry and Interior Department.....	Selection of live stock.....	Indian Office bears expenses of inspection.
Do.....	Testing horses for glanders.....	
Bureau of Animal Industry and Indian Office.....	Testing cattle at Indian schools and on Indian reservations.....	
Bureau of Animal Industry and Department of Commerce and Labor.	Exportation of meat.....	
Bureau of Animal Industry and Bureau of Public Health and Marine-Hospital Service, Treasury Department.	Preparation of index catalogue of medical and veterinary zoology.....	Office of Public Health and Marine-Hospital Service furnishes on-rehalt clerical assistance (approximately \$2,800).
Bureau of Plant Industry and Office of Indian Affairs.....	Testing and demonstration work in crop physiology and breeding.....	Office of Indian Affairs furnishes land and necessary labor.
Bureau of Plant Industry and Reclamation Service.....	Study of fruit diseases on reclamation projects in New Mexico and Nevada.	Reclamation Service furnishes field material and facilities.

Do.....	Investigations and experiments in crop rotation and cultivation.	Reclamation Service furnishes land, laboratory facilities, and all necessary common labor.
Do.....	Investigations in connection with utilization of lands reclaimed under reclamation act.	Reclamation Service furnishes farm units for use as experiment farms; irrigation water; and certain fences, wells, and buildings.
Bureau of Plant Industry and Bureau of Standards.....	Paper-plant investigations.....	Bureau of Standards furnishes facilities for analyses and tests.
Forest Service and Reclamation Service.....	Preservation of favorable watershed conditions on national forests.	Reclamation Service furnishes salary and expenses of experts.
Forest Service and Geological Survey.....	Study of geological and geographical conditions on national forests preliminary to extensive water development.	Geological Survey furnishes salary of expert.
Do.....	Stream measurements.....	Joint investigation.
Do.....	Examination of claims on national forests.....	Certain forest surveys accepted by Land Office. Mutual exchange of maps and other data concerning public lands.
Do.....	Survey of agricultural claims in national forests.....	Indian Office furnished \$1,031.85.
Forest Service and Office of Indian Affairs.....	Marking timber on Indian reservations.....	War Department furnished \$23.86.
Forest Service and War Department.....	Examination of trees and plan for their care at Augusta Arsenal.	
Do.....	Examination of forest conditions at Fort Sheridan Military Reservation.	
Do.....	Examination of forest conditions at Fort Washington Military Reservation.	
Do.....	Examination of trees and plan for care, Watertown Arsenal.	War Department furnished \$28.62.
Do.....	Examination of trees and plan for care, Watervliet Arsenal.	War Department furnished \$42.58.
Do.....	Estimate of forest-fire damage, Fort Meade Military Reservation.	
Do.....	Examination of forest conditions, Fort Huachuca Military Reservation.	
Do.....	Supervision of timber sales, Fort Wingate.	
Do.....	Examination of trees and plan for care, Frankford Arsenal.	
Do.....	Supervision of tree planting, Saundersdown Military Reservation.	
Do.....	Fire protection on national forests.....	War Department furnished \$12.70.
Do.....	Preservation of ties, posts, and poles.....	
Forest Service and State Department.....	Paper-pulp tests of certain Mexican woods.....	
Forest Service and Department of Commerce and Labor.....	Collection of statistics of annual production of forest products of the United States.	War Department furnishes heliographs and other instruments; troops furnished in emergencies to fight fires.
Bureau of Chemistry and Bureau of Standards.....	Study of paints.....	War Department furnishes material and apparatus.
Bureau of Chemistry and Bureau of Fisheries.....	Study of water used in hatcheries.....	State Department furnishes material f. o. b. laboratory Madison, Wis.
Bureau of Chemistry and Department of Justice.....	Study of snuffler tumors.....	Department of Commerce and Labor collects, tabulates, and publishes the statistics. Forest Service writes the reports.
Bureau of Chemistry and Post Office Department.....	Examination of postal laws.....	
Bureau of Chemistry and various departments.....	Examination of materials submitted with bids and taken from deliveries.....	
Bureau of Soils and Post Office Department.....	Soil studies of certain tracts, investigations of land companies for fraud.	Bureau of Soils furnishes maps and other data.
Bureau of Soils and Department of Justice.....	Soil problems. Investigations of utilization of smelter waste.	
Bureau of Soils and Reclamation Service.....	Study of problems dependent on soils.	
Bureau of Entomology and Treasury Department.....	Regulation of importation of plants.	

Cooperation with other departments—Continued.

Cooperating bureaus.	Character of project.	Method of cooperation.
Bureau of Entomology and Interior Department.....	Regulation of insect infestations in national parks.....	Interior Department furnished \$500; Bureau of Entomology bears all other expenses.
Biological Survey and Interior Department.....	Study of bird reservations.....	
Biological Survey and Hospital.....	Extermination of ground squirrels to prevent plague.....	
Office of Experiment Stations and Interior Department.....	Drainage plan for Yakima Indian Reservation.....	
Office of Experiment Stations and Bureau of Education.....	Collection and publication of statistics on agricultural education.....	Interior Department furnished expenses of expert (\$234.82).
Office of Public Roads and Post Office Department.....	Inspection and reporting on rural free-delivery routes.....	
Office of Public Roads and State Department.....	Obtaining and compiling data on road work in foreign countries.....	
Office of Public Roads and Department of Commerce and Labor.....	do.....	

EXHIBIT D.*Cooperation with States and institutions.*

Cooperating bureaus.	Character of project.	Method of cooperation.
Weather Bureau and various States.....	Collection and dissemination of meteorological data.....	Some States provide clerical help; some publish results; some furnish equipment and observers.
Weather Bureau and various smaller institutions.....	Collection of climatic statistics.....	Some institutions provide quarters and equipment.
Bureau of Animal Industry and Alabama Experiment Station.....	Beef-production experiments.....	Alabama Experiment Station furnished \$500; all other expenses borne by Bureau of Animal Industry.
Bureau of Animal Industry and Colorado Experiment Station.....	Breeding American carriage horses.....	Colorado Experiment Station furnished \$4,500; all other expenses borne by Bureau of Animal Industry.
Bureau of Animal Industry and Iowa Experiment Station.....	Breeding gray draft horses.....	Iowa Experiment Station furnished \$1,000; all other expenses borne by Bureau of Animal Industry.
Bureau of Animal Industry and Maine Experiment Station.....	Poultry breeding.....	Maine Experiment Station furnished \$1,000; all other expenses borne by Bureau of Animal Industry.
Bureau of Animal Industry and Minnesota Experiment Station.....	Milking Shorthorn investigations.....	Minnesota Experiment Station furnished \$1,000; all other expenses borne by Bureau of Animal Industry.
Bureau of Animal Industry and North Dakota Experiment Station.....	Holstein cattle breeding.....	North Dakota Experiment Station furnished \$500; all other expenses borne by Bureau of Animal Industry.
Bureau of Animal Industry and Vermont Experiment Station.....	Breeding Morgan horses.....	Vermont Experiment Station furnished \$750; all other expenses borne by Bureau of Animal Industry.
Bureau of Animal Industry and Pennsylvania.....	Animal nutrition investigations.....	Pennsylvania State College furnished \$3,500; all other expenses borne by Bureau of Animal Industry.
Bureau of Animal Industry and various State institutions and offices.....	Production of antihog cholera serum.....	Institutions and offices furnish animals and provide for their care during experiments.

Bureau of Animal Industry and agricultural colleges of North Dakota, California, Idaho, Ohio, Utah, Oklahoma, Montana, Virginia, Maryland, Texas, Pennsylvania, Indiana, Mississippi, Tennessee, Georgia, North Carolina, South Carolina, and experiment stations of Alabama, Colorado, Idaho, Maryland, Mississippi, South Carolina, Tennessee, Georgia.	Experiments in improving quality of butter, and building and operating creameries.	Different facilities are furnished; usually full facilities for work, including buildings and other equipment, office space, and clerical assistance. Some furnish also field assistants.
Bureau of Animal Industry and dairy and departments of Minnesota, Iowa, Kansas, Michigan, Virginia.	.....do.....	Do.
Bureau of Animal Industry and State colleges of Iowa and Pennsylvania, Ohio State University, Washington Experiment Station, New Hampshire Agricultural College, Maryland Experiment Station, Minnesota Agricultural College, University of Illinois.	Cow test association work.	Different facilities are furnished; usually publish results and sometimes furnish men to supervise work.
Bureau of Animal Industry and Columbia Experiment Station, Missouri.	Study of composition of milk as affected by feed.	
Bureau of Animal Industry and Connecticut Experiment Station, Storrs.	Cheese experiments.	Connecticut Experiment Station furnishes laboratory and material and three assistants.
Bureau of Animal Industry and Wisconsin Experiment Station.	.....do.....	Wisconsin Experiment Station furnishes laboratory and facilities and three assistants. In addition three members of station staff take part in investigation.
Bureau of Animal Industry and dairy and food department, Michigan; department agriculture, Vermont; department agriculture, Maine.	Cow test association work.	Different facilities are furnished; usually publish results and sometimes furnish men to supervise work.
Bureau of Animal Industry and various States.	Tick eradication.	States have furnished \$130,000.
Bureau of Animal Industry and Minnesota Experiment Station.	Study of infectious diseases of animals.	Minnesota Experiment Station furnishes laboratory equipment and material, stables, and services of attendant.
Bureau of Animal Industry and Utah Experiment Station.	Study of sheep diseases.	Utah Experiment Station furnishes laboratory facilities, feed, and care of animals.
Bureau of Animal Industry and Delaware Experiment Station.	Study of autogenic vaccines and cerebro-spinal meningitis.	Delaware Experiment Station furnishes laboratory and labor for handling animals.
Bureau of Animal Industry and Pennsylvania Live-stock Sanitary Board.	Study of milk hygiene.	Live-stock board furnishes laboratory and equipment.
Bureau of Animal Industry and various State institutions.	Tuberculin testing of cattle.	Institutions furnish help in handling cattle, and in some cases expenses of inspector.
Bureau of Animal Industry and Connecticut Experiment Station, University of Wisconsin, Iowa State College, University of North Carolina, Colorado Experiment Station, Mississippi Agricultural College, Idaho Agricultural College.	General cooperative work of more or less permanent character.	
Bureau of Animal Industry and Virginia Experiment Station.	Tuberculin testing of cattle.	Virginia furnished \$2,500 to indemnify owners of condemned animals.
Bureau of Animal Industry and Iowa Experiment Station.	.....do.....	
Bureau of Animal Industry and Minnesota Experiment Station.	.....do.....	Minnesota furnished buildings.
Bureau of Animal Industry and Oregon Experiment Station.	.....do.....	
Bureau of Animal Industry and District of Columbia Experiment Station.	.....do.....	
Bureau of Animal Industry and New York, New Jersey, West Virginia, Illinois, Michigan, Ohio, Maryland, California, Kansas, Colorado, Montana.	Tuberculin testing of cattle.	

Cooperation with States and institutions—Continued.

Cooperating bureaus.	Character of project.	Method of cooperation.
Bureau of Plant Industry and State and county horticultural commissioners in California, Oregon, Washington, Colorado.	Miscellaneous fruit-disease investigations.....	Facilities for investigations are furnished by horticultural commissioners.
Bureau of Plant Industry and Massachusetts Experiment Station.	Cranberry-disease investigations.....	Massachusetts Experiment Station furnishes assistance.
Bureau of Plant Industry and horticultural inspection and forest services of Atlantic Coast States, Ohio, Indiana, Wisconsin, Michigan, Minnesota.	Blister rust of white pine.....	Cooperation to amount of about \$10,000 per annum is furnished; Bureau of Plant Industry bears all other expenses.
Bureau of Plant Industry and North Carolina Experiment Station.	Breeding wilt-resistant watermelons.....	North Carolina Experiment Station furnishes about \$200 per annum in fertilizers and labor.
Bureau of Plant Industry and Virginia Truck Experiment Station, Norfolk.	Control of truck-crop diseases.....	Truck Experiment Station furnishes partial supervision of experiments and use of land for small part of them; all other expenses borne by Bureau of Plant Industry.
Bureau of Plant Industry and South Dakota Experiment Station.	Breeding sugar beets.....	South Dakota Experiment Station furnishes about \$600 per annum, land (2 acres), laboratory facilities, and services of chemist to analyze beets.
Bureau of Plant Industry and Utah Experiment Station.	Bacteriological examinations of soils of dry and irrigated areas.....	Utah Experiment Station furnishes laboratory supplies and equipment.
Bureau of Plant Industry and California Experiment Station.	Cooperative date garden, Mecca, Cal.....	California Experiment Station furnishes land; all other expenses borne by Bureau of Plant Industry.
Bureau of Plant Industry and Arizona Experiment Station.	Cooperative date gardens, Tempe and Yuma.....	Arizona Experiment Station furnishes land, maintenance of gardens, and assistance.
Bureau of Plant Industry and Tennessee Experiment Station.	Acclimatization and adaptation of cotton.....	These experiments are borne by Bureau of Plant Industry.
Bureau of Plant Industry and University of Wisconsin.....	Cultural and testing garden for drug and related plants.....	University furnishes land (2 acres), labor, tools, fertilizers, expert supervision and direction, and technical assays of products.
Bureau of Plant Industry and Illinois Experiment Station.	Paper plant investigations.....	Facilities for analyses and tests are furnished; also experimental material.
Bureau of Plant Industry and Louisiana Experiment Station.	.....do.....	Do.
Bureau of Plant Industry and experiment stations of Kentucky, Iowa, Wisconsin.	Hemp cultivation experiments.....	Land to amount of 33 acres is furnished; also labor and tools.
Bureau of Plant Industry and Porto Rico Experiment Station.	Flax and other fiber experiments.....	Land to amount of 50 acres is furnished, and labor for part of work.
Bureau of Plant Industry and Nebraska Experiment Station.	Cooperative seed-testing laboratory.....	Experiment station furnishes \$400 in clerical assistance; also maintenance of laboratory room.
Bureau of Plant Industry and Missouri Experiment Station.	.....do.....	Do.
Bureau of Plant Industry and Oregon Experiment Station.	.....do.....	Do.
Bureau of Plant Industry and Indiana Experiment Station.	Cooperative seed-testing laboratory.....	Indiana Experiment Station furnishes \$1,000 in scientific assistance; also maintenance of laboratory room.
Bureau of Plant Industry and North Carolina Department of Agriculture.	.....do.....	Department of Agriculture of North Carolina furnishes \$2,500 in scientific and clerical assistance; also maintenance of laboratory room.

Bureau of Plant Industry and North Dakota Experiment Station.	Wheat milling and baking investigations.....	Experiment station furnishes use of milling and baking apparatus, salary of miller, chemical work, and office.
Bureau of Plant Industry and Louisiana Experiment Station.	Rice investigations and improvement.....	Louisiana contributed about \$8,500 in buildings, equipment, salaries, and labor.
Bureau of Plant Industry and experiment stations of 17 States.	Demonstrations and tests of improved corn varieties and methods of culture.	Land and expert labor for experiments were furnished by experiment stations.
Bureau of Plant Industry and experiment stations of Montana, North Dakota, Oregon, Utah, and Kansas.	Improvement of grains for the dry land and intermountain districts.	Oregon furnished about \$25,000 in land, buildings, farm equipment, salaries, and labor; Utah \$1,800 in salaries and labor, also land and station buildings; other States furnished land, buildings, equipment, and labor.
Bureau of Plant Industry and experiment stations of Maryland, New York, Iowa, Minnesota, and Nebraska.	Improvement of grains for the Middle Atlantic regions, the North West, etc.	Experiment stations furnished land, buildings, machinery, farm labor, and all other facilities.
Bureau of Plant Industry and experiment stations of Connecticut, Massachusetts, New York, Pennsylvania, Ohio, Kentucky, Virginia, Maryland, North Carolina, and Texas, and Department of Agriculture of North Carolina.	Tobacco investigations and improvement, control of tobacco diseases, etc.	Connecticut furnished \$700; Massachusetts, \$500; New York, \$2,400; Ohio \$2,000; Kentucky, \$800; Virginia, \$3,000; Maryland, \$2,000; North Carolina, \$300; Texas, \$1,000; North Carolina Department of Agriculture furnished \$250.
Bureau of Plant Industry and experiment stations of Montana, North Dakota, Kansas, and Nebraska.	Crop rotation and cultivation experiments and investigations.	Land, buildings, laboratory facilities, and all necessary common labor, furnished by experiment stations.
Bureau of Plant Industry and Oregon Experiment Station.	Investigations in connection with utilization of lands reclaimed under reclamation act.	Experiment station contributes \$5,000 per annum.
Bureau of Plant Industry and Nebraska Experiment Station.	Breeding alkali-resistant crop plants.....	Land and farming facilities furnished by experiment station.
Bureau of Plant Industry and North Dakota Experiment Station.	Breeding drought-resistant and winter-proof strains of alfalfa.....	Do.
Bureau of Plant Industry and State of Washington.	Investigations of logged-off lands.....	State furnishes \$2,500 per annum.
Bureau of Plant Industry and experiment stations of Maryland and Kentucky.	Study of types of farming and their relation to soil types.....	Experiment stations furnish land and carry on cooperative work.
Bureau of Plant Industry and experiment stations of Arizona and New Mexico.	Range and cactus investigations.....	Facilities and assistance in carrying on the work. Arizona also furnishes about \$200.
Bureau of Plant Industry and Missouri Botanical Garden.	do.....	Do.
Bureau of Plant Industry and Alabama Experiment Station.	Farm management and soil improvement investigations.....	There is furnished by experiment station assistance in planning and conducting investigations and general supervision of work.
Bureau of Plant Industry and Wisconsin Experiment Station.	Investigations of farm economies.....	Wisconsin furnishes \$1,800 and supplies.
Bureau of Plant Industry and experiment stations of Ohio and Missouri.	General farm management investigations.....	Ohio furnishes \$2,600, Missouri \$1,100 and supervision of work.
Bureau of Plant Industry and Virginia General Education Board.	Demonstration work.....	State furnishes \$15,000.
Bureau of Plant Industry and North Carolina General Education Board.	do.....	State board furnishes \$24,000.
Bureau of Plant Industry and South Carolina General Education Board.	do.....	State furnishes \$5,000; State General Education Board furnishes \$22,000.
Bureau of Plant Industry and Georgia General Education Board and Georgia Agricultural College.	do.....	General Education Board furnishes \$32,000; Georgia Agricultural College, \$1,500.
Bureau of Plant Industry and Louisiana Agricultural College and Southwest Industrial Institute.	do.....	State Agricultural College furnishes \$1,800; Southwestern Industrial Institute, \$480.
Bureau of Plant Industry and Florida General Education Board.	do.....	General Education Board furnishes \$5,000.

Cooperation with States and institutions—Continued.

Cooperation bureaus.	Character of project.	Method of cooperation.
Bureau of Plant Industry and Florida General Education Board.	General administration of work.....	General Education Board furnishes \$8,000.
Bureau of Plant Industry and Vermont Experiment Station.	Potato investigations.....	General cooperation.
Bureau of Plant Industry and Louisiana Experiment Station.	Peanut investigations.....	Do.
Bureau of Plant Industry and Virginia Truck Experiment Station.	Truck crop investigations.....	Do.
Bureau of Plant Industry and Iowa Experiment Station.	Mississippi Valley hardy-fruit breeding investigations.....	Experiment station contributed \$600 to the work.
Bureau of Plant Industry and North Carolina Department of Agriculture.	Roundloftia grape investigations.....	General cooperation. State Department of Agriculture performs cultural work in connection with experiments.
Bureau of Plant Industry and New Jersey Experiment Station.	Reestablishment of grape culture in Middle Atlantic States.....	Experiment station bears salary and expenses of station horticulturist for portion of time devoted to cooperative work.
Bureau of Plant Industry and Iowa Experiment Station.	Plant-introduction garden, Ames, Iowa.....	Experiment station furnishes land and technical assistance.
Bureau of Plant Industry and Virginia Experiment Station.	Cooperative experiments on bluegrass pastures and with soy beans and alfalfa.....	Experiment station furnishes land, buildings, fences, and fertilizers.
Bureau of Plant Industry and Ohio Experiment Station.	Cooperative investigations in timothy breeding.....	Experiment stations furnish land and technical assistance.
Bureau of Plant Industry and experiment stations of Florida and Louisiana.	Cooperative experiments in testing of cowpeas, velvet beans, and other legumes.....	Experiment station furnishes land and technical assistance.
Bureau of Plant Industry and Washington Experiment Station.	Cooperative experiments with forage crops, especially alfalfa and Canada peas.....	Experiment station furnishes land and technical assistance.
Bureau of Plant Industry and Texas Experiment Station.	Cooperative experiments with dry-land forage crops, Chilocotho.....	Experiment station furnishes team of horses and part of the agricultural machinery.
Bureau of Plant Industry and South Dakota Experiment Station.	Cooperative experiments in testing and breeding of hardy alfalfas.....	Experiment station furnishes land and technical assistance.
Bureau of Plant Industry and Kansas Experiment Station.	Feeding experiments with Melilotus, Manhattan, Kans.....	Do.
Bureau of Plant Industry and Colorado and East Oregon Experiment Stations.	Commercial production of sugar-beet seed.....	Experiment stations furnish chemicals, apparatus, labor, land, buildings, etc.
Forest Service and Virginia.....	Examination of State as basis for a State forest policy.....	State furnishes \$250 to meet half the expenses.
Forest Service and Mississippi.....	do.....	Do.
Forest Service and South Carolina.....	do.....	Do.
Forest Service and Tennessee.....	do.....	Do.
Forest Service and Kentucky.....	Detailed study of forest resources.....	State furnishes \$200 to meet half the expenses.
Forest Service and Illinois.....	do.....	Do.
Forest Service and Connecticut.....	Study of second-growth hard woods and their management.....	State furnishes \$1,750 to meet half the expenses.
Forest Service and Wisconsin.....	Study of taxation of woodlands.....	State furnishes \$498 to meet half the expenses.
Forest Service and Washington State.....	do.....	State furnishes \$612.54 to meet half the expenses.
Forest Service and California.....	Study of eucalyptus.....	State at least supplies the material now being collected by commission on forest products.
Forest Service and Colorado College.....	Experiments in silviculture.....	State furnishes field assistance.
Forest Service and University of Montana.....	do.....	College furnishes tools and labor.
Forest Service and North Carolina.....	Study of forest resources.....	Do.
		State furnishes \$400 to meet half the expenses.

Forest Service and Maryland Experiment Station.....	Study of basket-willow culture.....	Experiment station furnishes labor and implements, and ground for planting.
Forest Service and Virginia Experiment Station.....	do.....	do.....
Forest Service and University of Wisconsin.....	Preservation of timber used in the construction of silos.....	University furnishes facilities for testing and inspecting woods.
Do.....	General investigations into the mechanical and physical properties of wood, and a course of lectures in wood technology.....	University furnishes building, yard space, heat, and power.
Forest Service and North Carolina.....	Study of wood-using industries.....	State furnishes assistance (\$500).
Forest Service and Kentucky.....	do.....	do.....
Forest Service and Wisconsin.....	do.....	State furnishes assistance (\$400).
Forest Service and Maryland.....	Statistics of annual production of lumber in New York.....	do.....
Forest Service and New York.....	do.....	State collects and tabulates statistics of lumber production in the State.
Forest Service and University of Colorado.....	Mechanical tests of timber.....	University furnishes laboratory facilities.
Forest Service and University of Washington.....	do.....	do.....
Do.....	Construction and installation of an open-tank treating plant.....	University furnishes equipment.
Bureau of Chemistry and various States.....	Cooperation in enforcing food and drugs act.....	State officials act as collaborators for department.
Bureau of Soils and Pennsylvania State College.....	Study of soil conditions connected with fertilizer investigations. Adaptation of types of soil to various varieties of fruit.....	
Bureau of Soils and Alabama State Department.....	Preparation of soil surveys.....	State department furnishes \$10,000.
Bureau of Soils and Mississippi Geological Survey.....	do.....	Geological survey furnishes \$5,000.
Bureau of Soils and Missouri Agricultural College and Experiment Station.....	do.....	Agricultural college and experiment station furnish \$7,500.
Bureau of Soils and New Jersey Agricultural College and Experiment Station.....	do.....	Agricultural college and experiment station furnish \$1,200.
Bureau of Soils and New York Agricultural College.....	do.....	Agricultural college furnishes \$1,600.
Bureau of Soils and North Carolina State Department.....	do.....	State department furnishes \$1,000.
Bureau of Soils and North Dakota.....	do.....	State furnishes \$1,000.
Bureau of Soils and Pennsylvania Agricultural College.....	do.....	College furnishes \$5,000.
Bureau of Soils and Tennessee Geological Survey.....	do.....	Survey furnishes \$1,000.
Bureau of Soils and Washington Geological Survey.....	do.....	Survey furnishes \$5,000.
Bureau of Soils and West Virginia Geological Survey.....	do.....	Survey furnishes \$1,000.
Bureau of Soils and Wisconsin Geological Survey.....	do.....	Survey furnishes \$7,500.
Bureau of Entomology and Illinois.....	Study of forest insects.....	Laboratory and other facilities are furnished by State and institutions.
Bureau of Entomology and Virginia Department of Agriculture, Virginia Truck Experiment Station, and Virginia Agricultural Experiment Station.....	Study of truck-crop insects.....	
Bureau of Entomology and Pennsylvania.....	Investigation of grape-root worm.....	State furnishes \$400.
Bureau of Entomology and University of Wisconsin.....	Investigation of cranberry insects.....	University furnishes laboratory and other facilities and a superintendent.
Bureau of Entomology and Kansas Agricultural College.....	Demonstration of orchard spraying.....	
Bureau of Entomology and Utah Experiment Station.....	Investigation of alfalfa weevil.....	
Bureau of Entomology and experiment stations of various States.....	Investigation of Hessian fly.....	
Bureau of Entomology and Maryland and Pennsylvania.....	Study of bee culture.....	State zoologists furnish their time at \$1 per month.
Bureau of Entomology and Louisiana.....	Investigation of rice and sugar-cane insects.....	State provides laboratory.
Bureau of Entomology and Maryland Experiment Station.....	Study of spotted-lever tick.....	Experiment station furnishes services of entomologist.
Bureau of Entomology and Texas Experiment Station.....	Study of cotton insects and Argentine ant.....	do.....
Bureau of Entomology and Clemson College, Colorado.....	Study of cotton thrips and aphids.....	do.....

Cooperation with States and institutions—Continued.

Cooperating bureaus.	Character of project.	Method of cooperation.
Bureau of Entomology and Florida Experiment Station...	Study of white fly.....	
Bureau of Entomology and Tennessee Experiment Station.	Study of tobacco insects.....	
Biological Survey and Montana.....	Investigations of spotted fever.....	
Biological Survey and various States.....	Regulation of shipments of game.....	
Do.....	Assistance in developing policies of game protection.....	
Biological Survey and Michigan.....	Destruction of wolves.....	
Bureau of Statistics and Minnesota Agricultural College.....	Investigation of cost of production of farm products.....	
Office of Experiment Stations and various agricultural colleges and State directors of farmers' institutes.	Promotion of agricultural extension by suggesting methods of work, supplying statistical data, etc.	College furnishes services of statistician and about one-half expenses of investigation, amounting to about \$2,500.
Office of Experiment Stations and agricultural high schools, Baltimore County, Md., Manassas, Va., and other similar institutions.	Assistance in educational work in agriculture.....	
Office of Experiment Stations and Utah Experiment Station.	Cooperative drainage work.....	Experiment station furnishes \$1,000.
Office of Experiment Stations and Iowa.....	Assistance in drainage survey, upper Des Moines River.....	
Office of Experiment Stations and Tennessee Geological Survey.	Assistance in securing drainage data.....	State publishes results.
Office of Experiment Stations and State of California and California Experiment Station.	Drainage study of Forked Deer Creek.....	Do.
Office of Experiment Stations and State of Utah and Utah Experiment Station.	Irrigation investigations.....	State furnishes \$7,000; experiment station furnishes land, implements, machinery, etc.
Office of Experiment Stations and Idaho and Idaho Experiment Station.	.....do.....	Experiment station furnishes \$2,250.
Office of Experiment Stations and Wyoming.....	.....do.....	There is furnished by State and station \$1,375.
Office of Experiment Stations and Montana Experiment Station.	.....do.....	State furnishes \$2,000.
Office of Experiment Stations and Nevada Experiment Station.	.....do.....	Experiment station furnishes supervision and labor.
Office of Experiment Stations and North Dakota Experiment Station.	.....do.....	Experiment station furnishes supervision in part and labor.
Office of Experiment Stations and New Mexico Experiment Station.	.....do.....	Do.
Office of Experiment Stations and Iowa Agricultural College.	.....do.....	Station furnishes use of part of farm, equipment in part, supervision, and labor.
Office of Experiment Stations and Florida Experiment Station.	.....do.....	College furnishes land and equipment.
Office of Experiment Stations and North Carolina.....	.....do.....	Station furnishes assistance in planning and constructing small irrigation systems.
Office of Public Roads and various State institutions.....	Building demonstration roads and conducting experimental work and general expert advice.	State institutions furnish facilities and expenses.

EXHIBIT E.

Cooperation with communities.

Cooperating bureaus.	Character of project.	Character of cooperation.
Bureau of Animal Industry and Denison Board of Trade, Tex.	Demonstration of farm work.	Board of trade furnishes a farm with full equipment.
Bureau of Animal Industry and various communities.	Public demonstration of action of anti-hog-cholera serum.	Communities furnish animals and their care during experiments.
Bureau of Animal Industry and numerous communities.	Various testing and demonstration work of composition of butter.	
Bureau of Animal Industry and Carlisle and Hazen, Ark.	Tuberculin testing of cattle.	State veterinarian and 2 assistants help in work.
Forest Service and various communities in the West.	Road construction on national forests.	Communities usually contribute a portion of cost of construction.
Forest Service and city of Pittsburg.	Study of controlling floods by forestry.	City contributed \$1,500 to meet all expenses.
Bureau of Chemistry and various municipalities and localities.	Assistance in developing pure water supply.	Communities furnish full facilities and all expenses.
Bureau of Entomology and Contra Costa County, Cal.	Investigation of pear thrips.	County contributes \$1,200.
Bureau of Entomology and Santa Clara County, Cal.	do.	County contributes \$1,500.
Bureau of Entomology and Tulare County, Cal.	Investigation of orange thrips.	County contributes \$400.
Office of Experiment Stations and drainage district.	Belzoni drainage district, Washington County, Miss.	District contributes \$2,000.
Office of Public Roads and various localities.	Building demonstration roads and conducting experimental work and general expert advice.	Communities furnish facilities and expenses.
Bureau of Plant Industry and city of San Antonio.	Operation of San Antonio, Tex., experiment farm.	City furnishes land, buildings, and certain minor permanent improvements; all other expenses borne by Bureau of Plant Industry.
Bureau of Plant Industry and counties and citizens in Virginia.	Demonstration work in Virginia.	Counties and citizens have contributed \$4,412.50.
Bureau of Plant Industry and counties.	Demonstration work in North Carolina.	Counties have contributed \$5,360.
Bureau of Plant Industry and Franklin County, Ga.	Demonstration work in Georgia.	Franklin County has contributed \$200.
Bureau of Plant Industry and parishes of Louisiana.	Demonstration work in Louisiana.	Parishes of Louisiana contributed \$3,425.
Bureau of Plant Industry and counties and citizens.	Demonstration work in Mississippi.	Counties and citizens contributed \$5,825.
Bureau of Plant Industry and counties.	Demonstration work in Alabama.	Counties contributed \$3,300.
Do.	Demonstration work in Arkansas.	Counties of Arkansas contributed \$12,035.

EXHIBIT F.

Cooperation with local or private agencies.

Cooperating bureau.	Character of project.	Character of cooperation.
Weather Bureau and various railroad companies; over 3,000 individuals.	Collection of climatic statistics.....	Some railroads furnish equipment.
Bureau of Animal Industry and Wisconsin Dairymen's Association.	Cow test association work.....	Association members pay \$1 per cow. Total amount for 1911, \$22,300.
Bureau of Plant Industry and Rindge Land & Navigation Co., Stockton and Middle River, Cal.	Control of potato diseases.....	1911, 22,300 bushels land (10 acres) labor, use of launches and vehicles, and general cooperation.
Bureau of Plant Industry and farmers in Texas, Florida, Kansas, and Maryland.	Acclimatization and adaptation of cotton and corn.....	Use of land is furnished, from 1 to 43 acres.
Bureau of Plant Industry and Prof. C. U. Shepard, Summerville, S. C.	Culture and production of American tea.....	There is furnished land (60 acres) buildings, labor, factory, implements, and materials; also conducts cooperative technical investigations.
Bureau of Plant Industry and American Tea Co., Rantowles, S. C.	.....do.....	There is furnished land (25 acres), factory, implements, labor, and all expenses of cooperative work; also furnishes reports of cooperative work.
Bureau of Plant Industry and E. Clemens Horst Co., Wheatland, Cal.	Culture and improvement of American hops.....	There is furnished land (1 acre), labor, implements, and all other facilities for cooperative work.
Bureau of Plant Industry and R. S. Hepburn, Timmons-ville, S. C.	Cultural and testing garden for drug and related plants in South Carolina.	There is furnished land (10 acres), labor, materials, implements, fertilizers, seed beds, and slit shade.
Bureau of Plant Industry and five private cooperators in South Carolina.	Cultural tests of paprika and other red peppers on a demonstration scale.	There is furnished land (34½ acres), with curing barns, and all labor, materials, fertilizers, tools, etc.
Bureau of Plant Industry and A. Dickinson, Orange City, Fla.	Cultural and testing garden for American camphor, drug plants, etc., in Florida.	There is furnished land (54½ acres), with laboratory and factory buildings; also \$250 per annum for water rents, labor, tools, etc.
Bureau of Plant Industry and Arkansas Rice Growers' Association.	Paper plant investigations.....	There are furnished facilities for analyses and tests; also experimental material; hemp breaker valued at \$300 furnished by International Harvester Co.
Bureau of Plant Industry and company at Yale, Mich.....	Flax and other fiber experiments.....	There is furnished land (30 acres) and labor for part of work. Suspended charges aggregating \$3,470, for freight, terminal, elevation, storage, drying, and weighing.
Bureau of Plant Industry and Baltimore & Ohio R. R., Pennsylvania R. R., and Baltimore Chamber of Commerce.	Grain storage and transportation investigations, Baltimore, Md.	Furnish facilities for the handling, storing, and drying of grain, aggregating about \$300.
Bureau of Plant Industry and Illinois Central R. R. and elevator.	Grain storage and transportation investigations, Columbus, Neb.	Company furnishes facilities for handling, storing, and shipping 10,000 bushels corn, about \$250.
Bureau of Plant Industry and Shellabarger Grain Co.....	Grain storage and transportation investigations, Decatur, Ill.	Company arranges special shipments of corn as requested, from central Illinois to Baltimore and New Orleans.
Bureau of Plant Industry and Hall Baker Grain Co.; also North German Lloyd Steamship Co.	Ocean transportation of grain, New Orleans, La., to Copenhagen, Denmark; Baltimore, Md., to Bremerhaven, Germany.	Minimum rate of travel is furnished and permission to make observations on grain in transit.
Bureau of Plant Industry and two companies in California; also J. C. Bate, Miami, Fla.; W. E. Haskell, Jacksonboro, S. C.; W. M. Carroll, None, Tex.	Rice investigations and improvement.....	\$3,000 contributed in California; \$600 in Florida; about \$300 in South Carolina; and in Texas about \$1,000 in land, farm equipment, and irrigation water; also labor; all other expenses borne by Bureau of Plant Industry.

Bureau of Plant Industry and Akron (Colo.) Citizens' Association; Palhart (Tex.) Fair Association.	Crop rotation and cultivation experiments and investigations.	Land, buildings, laboratory facilities, and all necessary common labor are furnished by associations; all other expenses borne by Bureau of Plant Industry.
Bureau of Plant Industry and South Carolina Cotton Manufacturers' Association, also L. W. Parker fund.	Demonstration work in South Carolina.	Cotton Manufacturers' Association contributed \$1,000; all other expenses borne by Bureau of Plant Industry; \$1,000 also contributed by L. W. Parker fund.
Bureau of Plant Industry and citizens ¹ .	Demonstration work in eastern Texas.	Citizens contributed \$1,157.50; all other expenses borne by Bureau of Plant Industry.
Do. ¹	Demonstration work in western Texas.	Citizens contributed \$1,295; all other expenses borne by Bureau of Plant Industry.
Bureau of Plant Industry and Louisiana & Arkansas Railway.	Demonstration work in Louisiana.	Louisiana & Arkansas Railway contributed \$1,200.
Bureau of Plant Industry and citizens of Fort Smith ¹ .	Demonstration work in Arkansas.	Citizens of Fort Smith contributed \$1,200.
Bureau of Plant Industry and E. H. Morrison, Fairfield, Wash., 6 factories.	Commercial production of sugar-beet seed.	Chemicals, apparatus, land, labor, buildings, etc., are furnished by cooperating parties.
Bureau of Plant Industry and Chamber of Commerce, Bellingham, Wash.	Commercial production of Dutch bulbs in the United States.	Chamber of commerce furnishes land (10 acres), fences, house, stable, tool house, storage buildings, water supply, etc. (approximately \$12,000); all other expenses borne by Bureau of Plant Industry.
Forest Service and Atchison, Topeka & Santa Fe R. R. Co.	Administration of railroad lands, Zuni National Forest.	Railroad pays estimated cost of administration. Increased protection and efficiency of administration of forest lands is afforded.
Forest Service and North Idaho Forestry Association.	Administration of State and private lands, Coeur d'Alene National Forest.	Increased protection and efficiency of administration of national forest lands is afforded.
Forest Service and stock associations (2 National, 5 State, 62 local).	Administration of grazing business, all national forests; recommendations and advice.	Stock associations cooperate in an advisory capacity only; make recommendations regarding administration of various national forests.
Forest Service and Northern Pacific R. R.	Cooperation in fire protection.	Railroad agrees to clear right of way; furnishes free transportation, service guards, supplies, etc.
Forest Service and Great Northern R. R.	do.	Do.
Forest Service and Chicago, Milwaukee & Puget Sound R. R.	do.	Do.
Forest Service and Northern Pacific R. R.	Forest surveys and estimates of odd sections.	Railroad furnishes special assistance in fire protection.
Forest Service and various local companies.	Construction of telephone lines.	Railroad bears half of expenses; since 1907 has contributed \$12,000.
Forest Service and 37 different private owners.	Establishment of practice of forestry on private holdings.	Companies usually furnish labor for building and often also the wire.
Forest Service and Illinois Central R. R. and Pacific Coast Creosoting Co.	Tests to determine the effect of commercial processes of creosoting on the strength of structural timber.	Since Jan. 1, 1910, owners have contributed \$3,775; all other expenses borne by Forest Service.
Forest Service and manufacturers of creosote.	The analysis and manufacture of commercial coal-tar creosotes.	Manufacturers furnish samples of creosote f. o. b. laboratory; all other expenses borne by Forest Service.
Forest Service and Yellow Pine Manufacturers' Association.	Refining and grading of wood turpentine.	Association has contributed \$400 to the work.
Forest Service and Paint Manufacturers' Association of the United States and the Atlantic Turpentine Co.	do.	Practical tests and results obtained. Atlantic Turpentine Co. bears all expenses of cooperative work with that company.
Forest Service and American Paper & Pulp Association.	Ground-wood experiments in the manufacture of paper pulp.	Association furnishes paper and pulp machinery to value of approximately \$6,000 and materials for tests to value of \$1,200 per annum.

¹ Should be listed under cooperation with communities.

Cooperation with local or private agencies—Continued.

Cooperating bureaus.	Character of project.	Method of cooperation.
Forest Service and Chicago, Milwaukee & St. Paul Ry....	Preservative treatment of cross-ties.....	Railroad furnishes 1,600 ties f. o. b. laboratory and agrees to pay \$600 in cash, and will construct 1 mile of experimental track.
Forest Service and 6 manufacturers.....	Standard tests on the comparative efficiency of various wood preservatives.	Manufacturers furnish material for tests f. o. b. laboratory; all other expenses borne by Forest Service.
Forest Service and Camp Manufacturing Co.....	Experiments in treating gum insulator pins.....	Company furnishes all material f. o. b. laboratory; service bears all other expenses.
Forest Service and Northern Hemlock & Hardwood Manufacturers' Association.....	Tests to determine the mechanical properties of the commercial hardwoods of Wisconsin.	Association furnishes material for tests; all other expenses borne by service.
Forest Service and Berlin Mills Co., Portland, Me.....	Tests to determine the mechanical properties of white spruce and red spruce.	Company furnishes material for tests f. o. b. laboratory; all other expenses borne by Forest Service.
Forest Service and Yellow Pine Manufacturers' Association.	Tests to determine the mechanical properties of white spruce and red spruce.	Association furnishes material for tests; service bears all other expenses.
Forest Service and Illinois Central, Chicago, Milwaukee & St. Paul, and Chicago & Northwestern railways.	The effect of sap stain and solution used in its prevention on the strength of southern yellow pine.	Railroads furnish free transportation over their lines of material required for experimental work of the laboratory.
Forest Service and Wausau, Wis.....	Transportation of test material for experimental work of laboratory.	Building and yard space are furnished under exceptional terms.
Forest Service and Tennessee Coal & Iron Co., Birmingham, Ala.....	Ground wood pulp experiments.....	
Forest Service and Indianapolis, Columbus & Southern Traction Co., Columbus, Ohio.....	Preservation of mine timbers.....	
Forest Service and 400 wholesale lumber dealers.....	Preservation of ties.....	
Forest Service and Eagle Pencil Co., of New York City; Gulf Cedar Co., Richmond, Va.; American Lead Pencil Co., Hoboken, N. J.; Eberhard Faber, New York City.	Collection of wholesale market prices of lumber.....	Reports are furnished by cooperators.
Forest Service and U. S. Bobbin & Shuttle Co., Providence, R. I.....	Collection of wholesale prices of lumber f. o. b. mills.	Do.
Forest Service and National Hickory Association.....	Study of the woods which may be used as substitutes for the southern jumpers in the manufacture of lead pencils.	Tests are made by the cooperators.
Forest Service and Yellow Pine Manufacturers Association.	Study of the woods which may be used as substitutes for degwood and persimmon in the manufacture of shuttles.	Do.
Forest Service and Anaconda Copper Mining Co., Butte, Mont.....	Study of hickory manufacture and utilization.....	Association furnishes \$500 for field expenses; all other expenses borne by Service.
Forest Service and Northern Coal & Coke Co., Denver, Colo.	Study of the loss of yellow-pine lumber due to the exclusive manufacture of even lengths.	Association furnishes assistance.
Forest Service and ranchers using range on forest.....	Construction and experimental operation of a wood-preserving plant for treating ties, mine timbers, and telephone poles.	Company furnishes \$200 per month for one year; other expenses borne by Service.
Forest Service and Southern Platte Power Co., Central Colorado Power Co., and the Colorado Telephone Co., Colorado.	Tests on round timbers of various Rocky Mountain species, including mine timbers.	
Forest Service and Denver Reservoir Irrigation Co., Colorado.	Preservative treatment of fence posts on Routt National Forest.	Ranches contribute \$1,200; all other expenses borne by Forest Service.
Forest Service and Redwood Association.....	Tests of western red cedar, lodgepole pine, and Engelmann spruce telephone poles.	Companies furnish 60 standard telephone poles; all other expenses borne by Forest Service.
Forest Service and Parkside Realty Co., San Francisco, Cal.	Preservative treatment of timber used in irrigation work..	
	Strength tests of California redwoods.....	Company furnishes material for tests.
	Seasoning tests of eucalyptus poles.....	Do.

Forest Service and ranchers on Long and Honey Lake valleys, California.	Preservative treatment of posts and poles.....	Ranchers furnish material for tests.
Bureau of Entomology and various private owners, Oregon, Montana, Colorado.	Control of forest insects.....	
Bureau of Entomology and various associations, mill owners, steamship lines, railroad lines, and private individuals.	Various cooperative projects in control of fruit and truck insects.	
Biological Survey and National Association of Audobon Societies.	Protection of birds.....	
Office of Experiment Stations and Association of American Agricultural Colleges and Experiment Stations, American Nature Study Society, N. E. A.	Assistance in educational work in agriculture in schools and colleges.	
Office of Experiment Stations and local parties.....	Drainage surveys, Back and Jacobs Swamp, N. C.....	
Office of Experiment Stations and Idaho Irrigation Co....	Irrigation investigations, Modesto and Turlock Irrigation Districts.	
Office of Experiment Stations and F. R. Gooding, Idaho..	Irrigation investigations.....	Local parties furnish expenses of one engineer and assistants; all other expenses borne by Office of Experiment Stations. Company furnishes part supervision of work and measurement of water; all other expenses borne by Office of Experiment Stations. Mr. Gooding furnishes use of land; all other expenses borne by Office of Experiment Stations.

EXHIBIT G.

Animal Industry.

Authorized to cooperate with State officials in suppression of contagious diseases among live stock. (Act of Feb. 2, 1903, 32 Stat., 791.)

Plant Industry.

To collect, purchase, propagate, test, and experiment with seeds of interest to agriculture, including rare new seeds, bulbs, trees, shrubs, vines, cuttings, and plants, sixteen thousand six hundred and fifty dollars.

Plant Industry.

"For taxonomic investigations and the study of methods for the improvement of grazing lands, seventeen thousand six hundred and fifty dollars."

Chemistry.

May make all kinds of tests on plant life and forest products, including paper-pulp investigations and experiments. (Act of May 26, 1910.)

Plant Industry.

For testing and breeding fibrous plants which may be used for paper making.

Entomology.

"For investigations of insects affecting forests, fourteen thousand dollars."

"For investigations of insects affecting cereal and forage plants, twenty-five thousand dollars."

Forest Service.

"And hereafter officials of the Forest Service designated by the Secretary of Agriculture shall, in all ways that are practicable, aid in the enforcement of the laws of the States and Territories with regard to stock." (Act of May 23, 1908.)

Forest Service.

To seek, through investigations and the planting of native and foreign species, suitable trees for the treeless regions. (Act of May 26, 1910.)

Forest Service.

"For experiments and investigations of range conditions within national forests, and of methods for improving the range by reseedling, regulation of grazing, and other means, eleven thousand eight hundred and twenty dollars."

Forest Service.

For enabling the Secretary of Agriculture to test such plants and woods as may require tests to ascertain if they be suitable for making paper. (Act of May 26, 1910.)

Forest Service.

For investigation of methods of wood distillation and for the preservative treatment of timber, for timber testing, and for other investigations and experiments to promote economy in the use of forest products.

Forest Service.

Under "General expenses" the service is authorized to investigate or suppress forest insect ravages.

"Provided, that the exportation of dead and insect-infested timber only from said Black Hills National Forest shall be allowed until such time as the forester shall certify that the ravages of the destructive insects in said forests are practically checked, but in no case after July first, nineteen hundred and twelve."

For experiments and investigations of range conditions within national forests, and of methods of improving the range by reseedling, regulation of grazing, and other means, eleven thousand eight hundred and twenty dollars.

Biological Survey.

Includes preservation, distribution, introduction, and restoration of game birds and wild birds (act of May 25, 1900; 31 Stat., 187). Census of wild animals and game animals (act of Mar. 4, 1907; 34 Stat., 1256). Protection of game in Alaska (June 7, 1902; 32 Stat., 327). Wichita game preserves in Wichita National Forest (Jan. 24, 1905, 33 Stat., 614). Grand Canyon Game Preserve (June 29, 1906; 34 Stat., 607). National Bison Range. (Act of May 26, 1910, and preceding acts.)

Animal Industry.

For all necessary expenses for investigations and experiments in dairy industry. (Act of May 26, 1910.)

Office of Experiment Stations.

Irrigation investigations: To enable the Secretary of Agriculture to investigate and report upon the laws of the States and Territories as affecting irrigation * * * with special suggestions of the utilization of irrigation waters in agriculture.

Forest Service.

The service is aiding the survey by compiling a census of animals in the national forests and by using the services of the national forest officers in administering the other acts since the preserves are wholly or in part situated in the national forests.

Plant Industry.

To investigate and encourage the adoption of improved methods for farm management and farm practice. (Act of May 26, 1910.)

Plant Industry.

For investigation in connection with the utilization of lands reclaimed under the reclamation act and other areas in the arid and semiarid regions.

STATEMENT BY THE CHIEF OF THE BUREAU OF CHEMISTRY.

WASHINGTON, D. C., *January 9, 1911.*

Dr. A. D. MELVIN,

Chairman of the Committee of Bureau Chiefs.

DEAR SIR: I have read with great interest the report prepared as the result of the conferences held by the bureau chiefs on economy of administration, research, and coordination of the scientific work of the Department of Agriculture. The great part of the report consists of statements of the conditions which have been found, to which, of course, we all subscribe. There are, however, some very important elements in the conclusions which have been reached with which I am unable to agree. I ask, therefore, the liberty of filing with the board a supplementary report, in which my own views, based upon a long experience and I think careful observation, are set forth.

The views which I desire to express relate not only to the present condition of the scientific work, but also to the development of it in the future. Inasmuch as all I have to say rests solely upon the validity of a single proposition, I can best economize space and time by stating at the beginning what I consider the fundamental principle which should guide us in drawing conclusions from the facts which have been set forth. This principle is as follows:

The scientific investigations of the department should be combined into one organization, of which the Secretary of Agriculture, or the Assistant Secretary, as the Secretary may direct, shall be in direct control, and should be carefully segregated from the administrative work of the department. This principle, as you will see, is entirely opposed to the present organization of the work of the department, which we all admit has done so much for the advancement of agriculture, but which, in my opinion, entails a useless expense of energy and money and is therefore opposed to the true principles of economy and efficiency. Under the present organization of the department the great administrative bureaus are presided over by scientific men, and the administrative work which they do, judging from my own experience in the last ten years, excludes them from the scientific activities which they are supposed to follow. Not only is this the case, but under the present arrangement scientific men who are experts in one science are made directors of scientific work of an entirely different science and of the nature of which they, as specialists,

are not supposed, in the natural accumulation of human knowledge, to have expert conception. In other words, the scientific work of the Department of Agriculture at the present time is connected with a series of problems, daily increasing in number and complexity, and each one of which requires practically the aid of every known science in its elucidation. The natural result of this system is the continued multiplication and remultiplication of scientific centers in which, if the principle is logically carried out, every science will take part. Not only will there be a complete body of scientific men connected with each bureau, but, in the very necessity of the case in a logical sequence, with each particular problem. These scientific men will have no organic relation with the bureau in which that science is segregated and in which by this segregated union of scientific effort experience has shown the greatest economy and efficiency can be secured. Outside of the strictly scientific service of the department, this principle of unity of effort and direction has been more or less completely carried out. The organization of the shops, of the disbursing office, and of the Solicitor's office are examples of that kind of unity of work and supervision in the nonscientific work. I believe to a certain extent also the work in entomology of the whole department is under the supervision and an integral part of the Bureau of Entomology.

If the truth of the statement I made is recognized—that all the sciences are useful in agriculture—it must follow as a natural conclusion that the efficiency of the work in these sciences will depend upon the character of their organization. I can not conceive of a condition of affairs in which the work connected with the service of entomology to science would be improved or rendered more economical and efficient by starting entomological divisions in all the different bureaus and branches of bureaus. My idea of the high efficiency and perfection of the entomological work is to have it all under one direction. I do not mean by this that all the entomologists should work under one roof or in one location, but I mean that the work which they do for the Department of Agriculture should originate in and be subject to the direction of the Chief Entomologist. The workers, on the other hand, could be detailed to such localities and to assist in such special problems as might be necessary and desirable. A single entomologist segregated from all his professional brethren, no matter how eminent and industrious he might be, could not possibly be of the same service to the work of the department as if he were organically connected with his professional brethren and received from them the mutual help and support which all such organizations bring and to which he also could contribute such portions of generally useful knowledge as his own researches and experience might render available. That such an entomological service

would be more efficient and more economical and more harmonious is to me a proposition which is so nearly self-evident as to require hardly any additional illustration. If, on the other hand, the principle which is suggested in the conclusions of the tentative report of the bureau committee which I have received shall be put into effect, separate and distinct entomological service must, as a logical sequence, be furnished not only to each bureau, but to each problem under discussion which entomological studies may touch. If this be true of entomology it must also be true of botany and of chemistry and of all of the other sciences which serve agriculture. It will probably not be denied that among these sciences chemistry is the dominant one. There is scarcely a single problem in agriculture which is undertaken to which chemistry does not contribute.

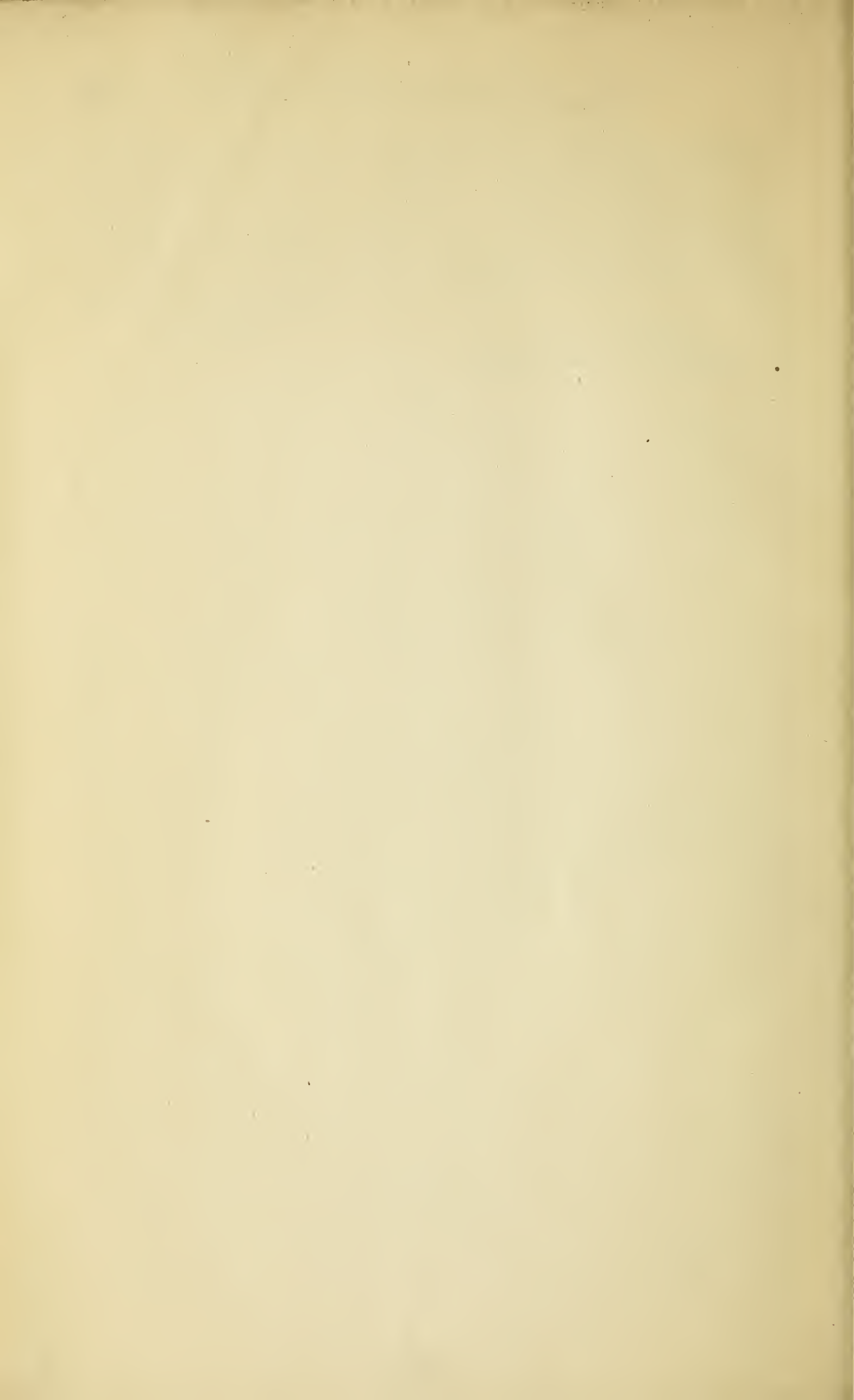
Chemistry is one of the two scientific bureaus which still bear the name provided for in the original act establishing the Department of Agriculture in 1862. Botany, the third science which was mentioned as among those to be established in the Department of Agriculture, has ceased to exist as a separate organization and has been merged in other bureaus whose names do not indicate any particular science. In fact, the particular names of some of the bureaus include practically an organization of scientific services which necessarily would be as complete as that for the whole Department, and that is true of all the sciences. Botany, entomology, chemistry, and physics are equally useful to the investigations of the Dairy Division, Animal Industry, Plant Industry, or the Bureau of Soils. There is hardly a problem which any of these great bureaus may undertake to examine which does not involve at once the employment of experts in practically all the branches of science I have mentioned. That the multiplication of units of service of a single science and their distribution to the various bureaus could be otherwise than wasteful and extravagant seems to me impossible of conception. That the most economical and efficient method of rendering these services is from a central organization seems to me to be equally self-evident. The harmonious working of scientific men, their sympathetic relations, etc., are of such importance that it seems to me to be a sufficient reason to segregate each individual science under a separate head and combine all of these heads into one organization presided over in some such manner as I have suggested. Such an organization would eliminate the petty jealousies, rivalries, and contentions, cement the bonds of scientific brotherhood, and give additional strength to the work. The old Latin fable teaches that the strength of the bundle (fascis) is in union as distinguished from the weakness of each individual constituent thereof. In a dispassionate and unbiased brief on the efficiency of the scientific service we should not forget the old adage "In union there is strength."

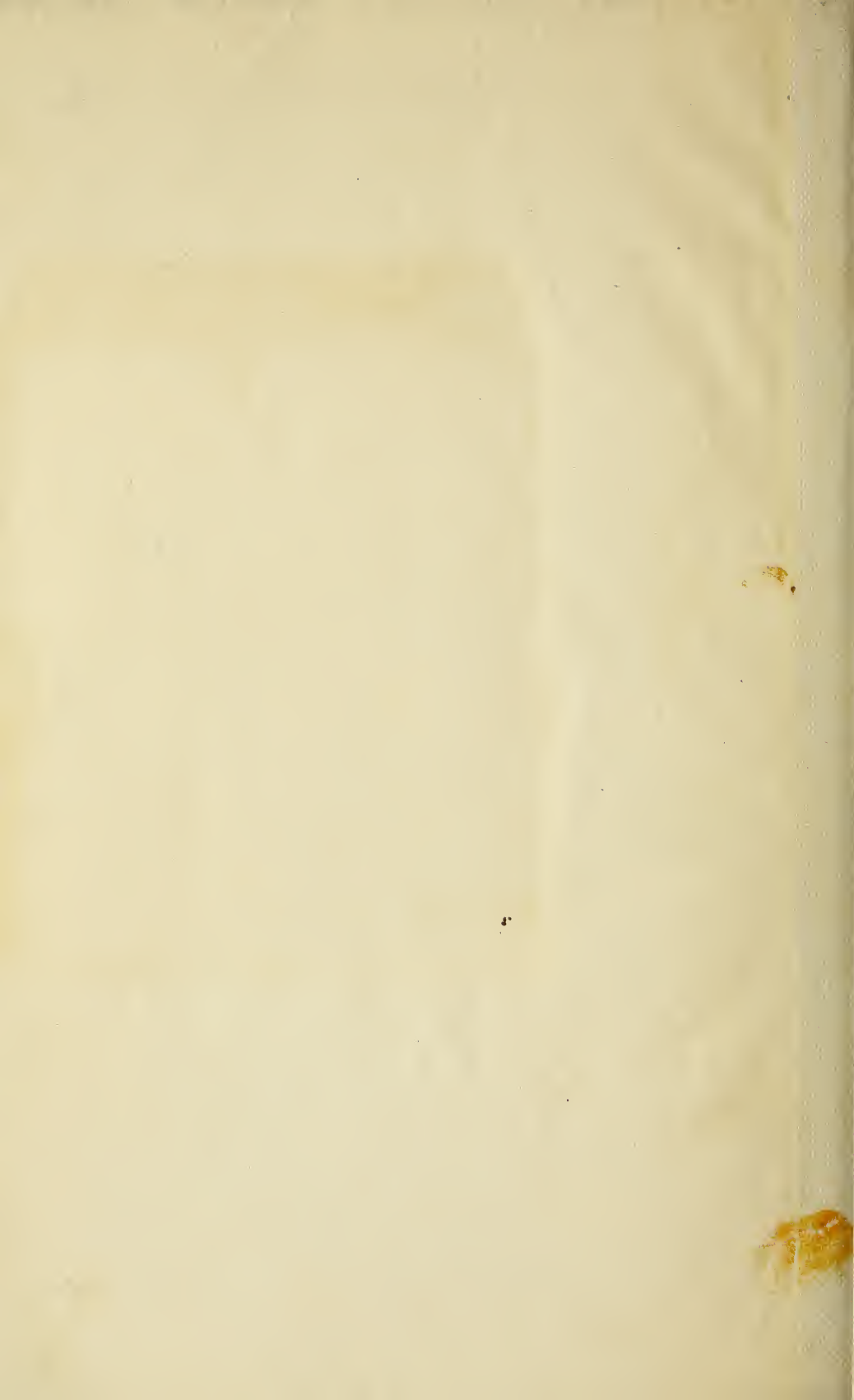
I might go into details in this matter but I consider it unnecessary to take up the time of the committee to any greater extent than to thus call their attention in as distinct a manner as possible to what I consider the cardinal principle involved in the efficiency and economy of the scientific service of the Department of Agriculture. I ask that a copy of this paper be attached to the report of the majority of the committee.

Respectfully,

H. W. WILEY,
Chief, Bureau of Chemistry.







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